PB-230 051

NATIONAL ESTUARINE POLLUTION STUDY. PROCEEDINGS OF THE PUBLIC MEETING HELD AT BOSTON, MASSACHUSETTS ON OCTOBER 8, 1968, AND WRITTEN STATEMENTS CONCERNING TIDAL WATERS OF MASSACHUSETTS

Federal Water Pollution Control Administration
Boston, Massachusetts

1968

DISTRIBUTED BY:

NTIS
National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 230 051

NATIONAL ESTUARINE POLLUTION STUDY

Proceedings of the
Public Meeting held at
Boston, Massachusetts
October 8, 1968

and

Written Statements Concerning
Tidal Waters of Massachusetts

Federal Water Pollution Control Administration
U. S. Department of the Interior
Northeast Region J. F. Kennedy Bldg. Boston, Massachusetts 02203

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

LIBRARY
Dept. of the Interior FWPCA
Edison, N. J. 08817

211

TABLE OF CONTENTS

PART I - ORAL STATEMENTS PRESENTED AT THE CHARTER ROOM, 225 CLARENDON STREET, BOSTON, MASSACHUSETTS, OCTOBER 8, 1968.

PAGE

Call to Order, Remarks, Introduction of Panel Members by Chairman Lester M. Klashman. 1

Speakers:

James King (representing Senator Edward M. Kennedy). 3

Representative Ralph E. Sirianni 9

Senator William L. Saltonstall 11

Representative Joseph C. Di Carlo. 17

Mrs. Nelson R. Saphir (representing Mayor James R. McIntyre - City of Quincy 26

(Senator Edward W. Brooke) 31

(Congressman William H. Bates) 32

(Senator Maurice A. Donahue) 34

Dean F. Bumpus (Senior Scientist, Woods Hole Oceanographic Institution). 34

David Mofenson (Democratic Candidate - State Representative 13th Middlesex District). 39

Irwin M. Alperin (Assistant Director, Massachusetts Division of Marine Fisheries) 42

(Henry D. Russell, Marine Biologist, PhD.) 46

Allen H. Morgan (Executive Vice President, Massachusetts Audubon Society). 47

Mrs. Roger Walke (representing Mrs. Bates of League of Women Voters) 53

Johnes K. Moore (Assistant Professor, Salem State College) 56

Donald R. Harleman (Professor of Civil Engineering, Massachusetts Institute of Technology). 58

Paul K. La Roque (Communications Director, New North River Ass'n.). . 61

PART I (Cont'd.)

PAGE

Gerald F. O'Leary (Boston City Council). 64

John W. Lebourveau (Environmental Engineer, New England Electric System) 65

Henry Lyman (Publisher, Salt Water Sportsman). 70

Dr. Charles F. Cole (Assoc. Professor Fishery Biology, University of Massachusetts) 81

Melbourne R. Carriker (Director, Systematics - Ecology Program, Marine Biological Laboratory) 85

Frank Backoff (Massachusetts Marine Fishery Advisory Committee and Izaak Walton League). 86

Mrs. Sherman L. Smith (representing neighborhood residents, Weymouth, Massachusetts). 92

Roger Marshall (Chairman - Eastern New England Group, The Sierra Club) 92

Warren W. Blandin (Waterfowl Biologist, Massachusetts Division of Fisheries & Game) 96

Alfred C. Conrod (Massachusetts Institute of Technology Experimental Astronomy Laboratory) 97

Miss Stella Trafford (League of Women Voters). 98

Dr. John T. Conover (Biological Oceanographer, Educator at Large). . 98

Benjamin W. Nason (Executive Director, Massachusetts Forest & Park Association) 103

Oscar Tenenbaum (Meteorologist in Charge, Department of Commerce, Weather Bureau) 106

Richard N. Loring (Vice President, Aquacultural Research Corp.). . . 106

Adjournment 107

PART II - WRITTEN STATEMENTS

Charles H. W. Foster
Charles River, Needham, Mass. 02192 109

K. C. Black
Scientific Analysis Corporation, 33 Sudbury Rd., Concord, Mass. 01742 115

PART II - (Cont'd.) PAGE

William E. Barbour
Southeastern Massachusetts Regional Planning District, 123 North Main Street, Fall River, Mass. 02720. 117

Dr. John H. Ryther
Dept. of Biology, Woods Hole Oceanographic Institution, Woods Hole, Mass. 02543 119

Dr. Donald R. F. Harleman
Dept. of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Mass. 02139. 122

Howard Whitmore, Jr., Commissioner
Metropolitan District Commission, Boston, Mass. 124

C. Francis Belcher, Executive Director
Mrs. Abigail D. Avery, Chairman, Conservation Committee
Appalachian Mountain Club, 5 Joy Street, Boston, Mass. 02108. . . 127

Robert G. Davidson, Executive Director
Metropolitan Area Planning Council, 44 School Street, Boston, Mass. 02108 130

Francis L. Archibald, Environmental Engineer
Boston Edison Co., 800 Boylston Street, Boston, Mass. 02199 . . . 134

E. Fletcher Davis, Executive Director
Cape Cod Planning & Economic Development Commission, Box 23, Hyannis, Mass. 02601. 135

Alfred C. Conrod
Dept. of Aeronautics & Astronautics, Massachusetts Institute of Technology, Cambridge, Mass. 02139 154

Dr. B. M. Fabuss, Technical Director
Environmental Pollution Division
Lowell Technological Institute Research Foundation
450 Aiken Street, Lowell, Mass., 01854. 160

Dr. William Vinal, Natural Resources Consultant
Massasoit Community College, North Abington, Mass. 02351. 161

Seconset Island Residents
Mashpee, Mass., 02649 164

James H. Ottaway, Jr., Publisher
The Standard-Times, New Bedford, Mass. 02742. 166

Ted Vincent, Editor
The Standard-Times, New Bedford, Mass. 02742. 167

APPENDICES Page

List of Participants at Boston, Massachusetts Public Meeting, October 8, 1968. 191

List of Other Attendees at Boston, Massachusetts Public Meeting, October 8, 1968. 193

INDEX (by Speaker, Author, and Organization). 199

P R O C E E D I N G S

(The public meeting for the National Estuarine Pollution Study was called to order in The Charter Room, 225 Clarendon Street, Boston, Massachusetts, on Tuesday, October 8, 1968, at 9:30 o'clock A.M., Lester M. Klashman presiding.)

CHAIRMAN KLASHMAN: Good morning, ladies and gentlemen, and welcome to our meeting.

My name is Lester M. Klashman and I am Regional Director for the Northeast Region of the Federal Water Pollution Control Administration. We are all here because we feel our coastal and estuarine waters are among our most precious resources.

The purpose of this public meeting is to have your views on the tidal waters of Massachusetts.

What do you think are the values of an estuary (aesthetic, recreational, dollar)?

Have estuaries been damaged by pollution - where + how much?

What should future of coastal zone be?

What are the best uses?

What system of management will best provide for development of our coastal resources?

This public meeting is the last of five in the Northeast Region. These meetings are being held in accordance with the Clean Water Restoration Act of 1966. The Federal Water Pollution Control Administration is charged by the Congress of the United States to prepare a comprehensive report of the status of water pollution in the Nation's coastal waters. The report will identify the actions needed to assure wise use of the total resources of our coastal zones so that not only will degradation of our valuable coastal waters be avoided, but also the quality of our waters may be enhanced. This effort is known as the National Estuarine Pollution Study. The report is scheduled for completion and submittal to the Congress on November 1, 1969. It will provide the Congress with the information it needs to draft legislation bearing on prevention and abatement of pollution in the Nation's coastal waters.

Because they feel our estuarine and coastal waters are so important, the Commonwealth of Massachusetts, The New England River Basins Commission and the New England Interstate Water Pollution Control Commission have joined the Federal Water Pollution Control Administration in co-sponsoring this public meeting.

The Governor has designated Mr. Robert Yasi of the Department of Natural Resources as liaison man for this National Estuarine Pollution Study. He is represented today by Mr. Albert Zabriskie. These men are channeling information from the various agencies in their State directly to the FWPCA's Office of Estuarine Studies, whose Acting Chief is Mr. Louis De Camp. This is also true for other Federal Agencies; for The New England River Basin Commission; and for The New England Interstate Water Pollution Control Commission, here represented by Mr. Alfred Peloquin.

We sent over 500 invitations to all organizations which we thought had an interest. However, be assured that this is a public meeting, and statements from all are welcome.

Those of you wishing to speak should have so indicated on the registration cards you made out when you entered. You will be asked to come to the rostrum in turn. The panel members may wish to ask clarifying questions, but we are not prepared to entertain questions from the floor. Our purpose is to collect information, and not to provide a forum for debate. If you decide to make a statement, and have not yet so indicated on your registration card, please inform the secretary at the registration table outside in the hall.

Those of you wishing to submit written statements either now or in the next few weeks are welcome to do so. The secretary will take them or tell you where to mail them.

We have a 35mm slide projector and an overhead projector. Please inform the secretary in advance if you wish to use these or your own projection equipment.

These proceedings are being taken by a recorder and will be published and sent to you. This is why we need your address on the registration cards. The written submissions will be included in the record. If you are planning to speak and have a written copy or outline, it would greatly aid the recorder if you let our secretary make a xerox copy of it in advance.

Thank you for your interest in these coastal waters which are among our most precious resources. Your thoughtful participation in this meeting will be helpful in providing for their protection and development.

Our first speaker today is Mr. James King, representing Senator Edward Kennedy.

MR. JAMES KING: The Director of the U. S. Bureau of Sport Fisheries and Wildlife said in 1965 that:

> The needs for public conservation education are tremendous, while fulfillment of these needs still is sadly lacking. Many conservation organizations must place emphasis -- now -- on the values of coastal wetlands and estuaries. An informed public is absolutely essential to the solution of this problem.

One declared purpose of this hearing today is fulfillment of this plea for public education -- education which is essential if the quickening interest in both restoring and conserving our natural resources is ever to be satisfied. This is why I am so pleased to have the opportunity to express my own views about the importance of cleaning up our estuaries, and my appreciation to all those who are making an effort to do so.

For many years in this country, the battle for preservation of our natural resources has been carried by small but dedicated groups of concerned citizens. In recent years, fortunately, both the size of these groups and their successes have grown markedly. In part, this growth is attributable to the sharpening clash between the public interest and private interests -- the public interest on the one hand in conserving our resources, and the rising pressure from the private interests, on the other hand, for commercial development or other use of these resources.

This clash grows sharper, I think, as the public education efforts of conservation groups gain strength. And these efforts succeed as laws and public agencies respond to the appeals of the concerned legislators. The agencies jointly conducting this hearing, for example, represent a mix of Federal, state and regional responsibilities, and this mix is at once a recognition both of the multiple responsibilities for getting our waters cleaned up, and the need for vigilance at every level of government.

Estuaries are important to the people of Massachusetts, for recreation and for livelihood alike. Thousands of people boat and swim in our coastal estuaries, while many more thousands fish in them. Twenty-two varieties of fish native to this area are dependent upon estuaries in one or another parts of their life cycles, and these fish are among the most important sport and commercial varieties we have. They include flounder, striped bass, porgy, bluefish, tautog, mackerel, shad and menhaden.

Without the estuaries, these fish will disappear. And without the estuaries, the recreational opportunities available to the growing number of people who look to the sea for sport will actually decrease.

Concern for our estuaries prompted me to introduce a bill in the Senate last year to require the Secretary of the Interior to identify the nation's most important estuarine areas, and to establish a system of National Estuarine Areas which would be forever preserved in their natural state. That bill passed the Congress this year, but in a form revised to reflect the austerity of the budget during the Vietnam War. As that law now stands as signed by the President, it requires the Secretary of the Interior to survey the estuaries of the United States, and to identify those appropriate for inclusion in a National System of Estuarine Areas. The actual creation of such a system would have to be authorized by Congress after the Secretary completes his report and presents it to the Congress in 1970.

We are fortunate in Massachusetts that this delay will not automatically defer the preservation of our estuaries. The Massachusetts General Court has passed two complementary bills, one in 1963 and the other in 1965, which set a goal of protecting from 50,000 to 60,000 acres of estuary lands, protecting them through the Commonwealth's zoning powers. Under the 1965 Act, the Massachusetts Department of Natural Resources can zone tidal marshlands against development, thus effectively preserving them. This is an effective and inexpensive solution to Massachusetts' overriding need to act now in preserving estuaries -- but it does not solve the problem in our neighboring states, whose estuaries are almost equally important in terms of producing the fish and other wildlife which abound in our waters. Nor does it identify those estuaries of significant national interest. For these reasons, I intend to follow the progress of the Interior Department study closely, and to urge those making it to examine the successes of the Massachusetts estuary preservation efforts.

An important aspect of estuaries preservation is both preventing and eliminating pollution. Clearly, estuaries can be preserved from filling and dredging, with determined action -- but if they are polluted, they will not breed fish and shellfish; nor will they be recreation resources. Thus, the National Estuarine Pollution Study of which this hearing is a part must be considered a critical aspect of the whole problem.

One of the most important estuarine areas in the entire Commonwealth of Massachusetts is Boston Harbor. Early this year, I asked the Federal Water Pollution Control Administration to make a survey of pollution in Boston Harbor and its attendant estuaries. The preliminary results of this survey, elicited in the May 1968 Conference, are, quite literally, shocking. They indicate that we have let pollution make the waters of some areas of Boston Harbor a real health hazard; that we are doing little to eliminate this pollution; and that matters are getting steadily worse. When this survey I requested is completed, I intend to work with the Water Pollution Control Administration in seeking appropriate action to clean up Boston Harbor.

Let me cite a few examples, from this preliminary report, of what pollution has done to Boston Harbor's estuarine waters:

There are about 4,500 acres of available shellfish beds in Boston;

today, only 500 acres are sufficiently free from pollution to permit unrestricted shellfishing. And these 500 acres are deemed only marginal. This amounts to an annual retail loss in Boston of about $750,000 a year;

The beaches in Winthrop have been closed to swimmers since 1962, and other beaches in Boston Harbor have been repeatedly threatened with closing;

The very high amounts of sewage discharged into Boston Harbor have greatly stimulated the growth of a seaweed, sea lettuce. At low tides, the sea lettuce is exposed to sunlight and air, and decomposes. As it decomposes, sea lettuce produces hydrogen sulfide odors -- the smell of rotten eggs. At times, these odors have been strong enough to drive residents of Winthrop from their homes. In addition, the hydrogen sulfide has discolored homes in Winthrop; and

Much of the bottom of Boston Harbor is covered with deposits of sludge, in places greater than three feet deep. This sludge is both oily residue and decaying organic matter discharged from sewage treatment plants.

These are only isolated examples of the effects of pollution in Boston Harbor developed by the preliminary study of the Federal Water Pollution Control Agency; but they indicate how serious the matter has become.

The methods and procedures for cleaning up the Harbor may well be determined by the recommendations to be submitted to the Congress in November 1969, as the result of the study for which this hearing is producing important information. The 1966 Clean Water Restoration Act directs the Interior Department to study the extent and nature of pollution in all our nation's estuaries, and then to recommend action to clean them up.

While we presently know the basics of what we must do to eliminate pollution in our estuaries, our progress is complicated by the multi-jurisdictional nature of estuarine waters. This jurisdictional complication played a large role in Congressional debate this year on the bill I introduced. Which department of the Federal government; whether the Federal as well as state governments had primary responsibility; what role should be singled out for each -- all these problems were thoroughly considered. Thus, recommendations of this estuarine pollution study can be most helpful in unraveling this problem of jurisdiction -- consequently leading us closer to our goal of clean waters.

In sum, let me express my own satisfaction that the pendulum seems at last to be swinging towards a balance between the needs for conservation and the pressures of commercial development. The interest and work of concerned citizens all across the country have caused the pendulum to begin its swing toward a balance -- but only through continuing efforts of this sort in public education can we be sure that it will not swing back, as our population and its affluence grows.

The late Rachel Carson was an articulate advocate of the view that this is a land which belongs not only to us, but to our children and their children. If in our temporal impatience we destroy the land, then we also destroy something in us. In one of her books devoted to the richness of life along our seashores, she described an estuary in these terms:

> (The island) lay across a quiet sound from which the banks shouldered away the South Atlantic rollers. To the north the island was separated from the mainland by a deep gutter where the ebbing tides raced strongly; on the south side the beach sloped gently, so that at slack water the fishermen could wade out half a mile before the water came above their armpits as they raked scallops or hauled their long seines.

> In these shallows young fishes swarmed, feeding on the small game of the waters, and shrimp swam with backward flipping of their tails. The rich life of the shallows brought the skimmers nightly from their nesting grounds on the banks, to take their food from the water as they moved with winnowing flight above it.
>
> About sunset the tide had been out. Now it was rising, covering the afternoon resting places of the skimmers, moving through the inlet, and flowing up into the marshes. Through most of the night the skimmers would feed, gliding on slender wings above the water in search of the small fishes that had moved in with the tide to the shelter of grassy shallows.

This is how our estuaries can and should be -- and not as repositories for trash, sewage, and sludge. But they will be as she described them only if we each care enough to act determinedly to preserve and restore them.

CHAIRMAN KLASHMAN: Thank you very much. Our next speaker is Representative Sirianni of the 20th Suffolk District.

REPRESENTATIVE SIRIANNI: Mr. Chairman, let me thank you at the outset for allowing me to make my presentation before anybody else. As I indicated to you, I have a public health council meeting at 9:30 this morning and I find it very difficult to be in two places at one time, but this is so important to all of us here in Massachusetts.

I know that many well qualified experts in the field of pollution from state and Federal agencies as well as industry will speak before this meeting today.

I am sure my views as a legislator will probably differ from those who are experts in the science and technology end of this pollution problem.

Only five short months ago I made a presentation to the Federal and state conference held in Faneuil Hall on May 20th.

In my presentation I was critical of the Federal Government from approaching this problem from the back door because, "The inability to market shellfish or shellfish products was the reason for the conference being called." My answer to that was "I surely will not minimize the necessity to investigate the economic injury resulting in the inability to market shellfish or shellfish products. However, it would appear to me that the health and well-being of the people living near these grossly polluted rivers, streams, lakes, and ocean shore lines, who are being subjected to inhale foul odors, whose homes have been damaged as a result of hydrogen sulfide gases emanating from grossly polluted mud flats, citizens who are denied the right to use recreational facilities as the result of infectious fecal material on beaches. It seems to me this would be the primary factor and motivating force to eliminate pollution."

Your letter of invitation dated August 27th suggested I make my views clearly known regarding present and potential problems faced in maintaining the quality of our coastal waters as related to land and water uses.

Therefore I make the following suggestions:

1. Let's not waste anymore valuable time and money in studies. The already recognized serious pollution problem has been studied to death.

More Federal money should be allocated toward subsidizing not only the building of new sewage treatment facilities, but the remodeling, renovating and repairs of older systems.

2. More stringent Federal laws and the enforcement of same to prevent individuals, industry, and yes, even state agencies such as M.D.C. from contaminating rivers, oceans, etc.

3. Stiffer penalties and fines to be imposed on violations of ships and boats who are responsible for oil spillage or pumping of bilges,

creating a very serious problem.

I am sure that many more suggestions will be made here today, all of which will be evaluated and considered when submitting your final report.

So in closing I would like to quote Secretary of Interior, Stewart Udall, "We have enhanced the future of everything-except the overall future of the human race."

With these words of wisdom in preparing the final report let's keep in mind business, industry, and the economics which are so important. But also let's keep in mind the human element the human factor, in other words the ordinary citizens, the people who are being jeopardized and penalized because of the pollution problem.

CHAIRMAN KLASHMAN: Thank you very much, Representative Sirianni. I would like to clarify again why the Federal Enforcement Conference directed its efforts towards the shellfish injury. The reason is that our law does not permit us to do otherwise and so we had no jurisdiction to come into the situation in any other way. Do you have any questions?

I would now like to ask, are there any other elected representatives in the room who would like to make a statement?

SENATOR SALTONSTALL: Do you want me to go ahead, Mr. Klashman? I am Senator William Saltonstall of the Third Essex District, the area which includes towns of Essex, Ipswich, Rockport and Rowley as well. It goes as far north as the Merrimack River and as far south as the Danvers River. Massachusetts has tried very hard to take a lead in solving the problems of our coastal estuary and wetland areas. Massachusetts has, as you've heard in Senator Kennedy's statement, passed two bills which will protect our coastal wetlands. The first one was principally established to protect the shellfish biological areas. The second, actually went further to include those areas which could be distinguished as coastal wetlands on a biological basis from the botany and the way they have been largely described is with aerial photographs. The first major area in Ipswich (there being a smaller one in the North River at Scituate previously) the first major area in Ipswich was set aside last summer in a hearing where only three people spoke against the setting aside of over a thousand acres of land and the meeting overwhelmingly supported it. At last report, not a single major objection had been made to setting aside that land, something, I think of which we in Massachusetts, particularly in Essex County, can be very proud. Massachusetts also, as you well know, but if perhaps some of the people here have not been familiar with, has been carrying on very significant hearings of estuarine studies, the biology and the problems of our major estuaries up and down the coast. This is being done by a laboratory on Plum Island, by the staff and they go up and down the coast to make these studies. Finally, we are very proud this last summer in passing a major landmark oil pollution, an oil slick prevention act. This was sponsored by the Attorney General, (I was proud to join in co-sponsoring it), which gives the state the power to go out and clean up the slicks before their origin is identified and sue the guilty parties later on if they can be identified. At least we can get rid of the slicks. Now, this is the leadership in Massachusetts. There are problems. We've moved slowly. I have, for instance, been appointed a member of two commissions to study pollution, to study cleaning up rivers. One on the North River in Salem, the other on the Merrimack. Neither of these commissions has as yet met, to my great disappointment, because I think these are problems we should be working on in the legislature and as a state.

Another problem can be illustrated by a town in my area where four times a sewage treatment plant has been on the ballot (it takes a 2/3 vote in that town for a bond issue) four times it has been on the ballot and four times regrettably it lost. Unfortunately, just to use an example, the engineering department in that town says that the economic place to put the sewage treatment plant is bounded by the harbor on one side, by a church, the Masonic Temple, the American Legion and the Post Office. These are the four bounding properties of the proposed sewage treatment plant. Regrettably, it has lost. On the other hand, in a city in the other end of my area, a plant which was built and which failed to work well for a number of years, but is now working so well that the Mayor has invited everybody down for a picnic on the sewage treatment plant grounds. We are all hoping to go. He held an exhibition there just the other day. But the reason this plant, and this goes on to some of our problems, the reason this plant has worked for a number of years and the reason the plants in Boston Harbor have caused so much trouble is the lack of qualified personnel. I hope that this is something that your body, Mr. Klashman, can work on in providing properly trained personnel to operate these plants. It is very hard to get them. This is an area, it's a business which doesn't have the glamour which some others do and where, I think, the Federal Government can by proper sponsorship be of great assistance. We finally, Mr. Chairman, have the problems of our industrial areas. Many of Massachusetts' industries are operating on a marginal basis. They are under strong competition from the South and we hope that as regulations are applied against these industries which will have to clean up their rivers, that they can be equally applied against all parts of the country. The water classifications, which were done last year, I think, are a major start towards this. But, if one industry has to clean up its water in one part of the country--a paper mill, an oil refinery or some other industry, be what it may, or even a city where major industry is carried on has to go to the added expense of cleaning up its water--this places that city in a competitive disadvantage with a similar city or similar industry in some other part of the country. Federal contribution has been a major source of equalization between the various parts of the country and the various industries. We hope very much that Federal funds can continue to come out for this purpose. The Vietnam War and budgetary constringencies have held us back but this is something that must move forward. Finally, I will just add that coastal pollution has been caused in part by private and fishing vessels. This is something in which I have corresponded with our own director of Natural Resources and I hope, that as time comes, when the economic time comes when we must put on restrictions on boats in crowded harbors, that this can be done without too much difficulty. As a yacht owner, I know that the cost of this is considerable. I also know that I like to swim over the side of my boat and I know many others do too. The problems in the inner-harbor, in Boston Harbor, are one thing but the problems in the delightful outer harbors are growing as marinas become more and more prevalent. So these are our problems that we are working on solving. I think that Massachusetts can be very proud of the leadership that has been taken here both by our Federal officials and by our State. We hope very much that it can be kept going.

CHAIRMAN KLASHMAN: Senator Saltonstall, could you wait just one moment. I think that there are questions.

MR. PELOQUIN: Could I comment briefly and advise further on the program in which the New England Interstate Water Pollution Control Commission has on the way now for training of waste treatment plant operators. We recognize the problem here and we did initiate a training program in March of this year--three one-week sessions for operators now in the industry. We have another session starting next Monday for two weeks and we have another contemplated for March 1969. Hopefully also, we will be able to establish a long-range training program to provide trained operators for these new plants which are now coming along on line and also to help fill the vacancies in existing plants.

SENATOR SALTONSTALL: That is very encouraging. How many students actually take part in each of the courses?

MR. PELOQUIN: We put through 94 students in March of this year. For the two courses we have scheduled now, we have 64 students registered and we average about 33 students per session.

SENATOR SALTONSTALL: Very encouraging. Thank you.

CHAIRMAN KLASHMAN: Senator Saltonstall, you mentioned the fact that there is a need for trained operators. We find that one of the problems of attracting people to this field is that the salary level is such that it is just not attracting the people that we want. Do you have any thoughts about anything that should be done at the Federal level to solve this problem?

SENATOR SALTONSTALL: Are you suggesting Federal subsidies have operations so that the salaries can be arranged. Very generous! But I am not sure that Congress would go along with that.

CHAIRMAN KLASHMAN: I am not suggesting that at all. Some thought has been given to Federal requirements for operative qualifications. In other words, there was introduced into the Congress a part of the bill which provided that, when a plant receives Federal aid, the plant would have to provide qualified operators and the operators would have to meet certain qualifications, and hopefully, this would upgrade the salary level.

SENATOR SALTONSTALL: Well, this is the sort of thing which we try in many areas of state government here. We do find, however, that if you establish a flat minimum qualification before the people are available that sometimes you find an establishment standing idle because the fully qualified person isn't available and perhaps the partially qualified person is available. This is sort of a hen and egg proposition. Naturally, nobody is going to go into the business until the jobs are there. So, we try, I think, or we can best succeed by bringing the two along together by getting the best qualified people we can, but not freezing the growth until the people are available, because then the people don't tend to go in the business until they know the jobs are there. So a Federal qualification might be reasonable but it should be sufficiently flexible in the first few years so that, if we have a plant but can't find the fellow to run it in a fully qualified manner, we can at least get it going. I think this has been illustrated in several of our areas in other industries. Say, for instance, in the areas of mental health, we have highly qualified people but we are actually also using retarded people to help even more retarded people in some cases and this is the sort of flexibility that I would suggest to your programs as well.

CHAIRMAN KLASHMAN: If we could get the support that the mental health programs have in Massachusetts, we'd be very happy.

SENATOR SALTONSTALL: I suggest you talk to the Commissioner about his budget.

He is still working on it.

CHAIRMAN KLASHMAN: Do I understand correctly that in some cases the State legislature actually sets the salary levels that can be paid to the operators at some plants. Isn't that true?

SENATOR SALTONSTALL: You have me there. I know that we have set some salaries in various professions. There is substantial resistance to it because what is a good salary in Boston, or a salary that will attract people in Boston, may be a very high salary in some of our other towns. This is the reason for resistance to legislative minimums.

CHAIRMAN KLASHMAN: I would suggest, however, that it might be of value to the legislature to recognize that, for example in New York City, which I don't think we can compare exactly to Boston, but the minimum salary paid to any man working in the plant is $8,000 a year. Until we are approaching this, I don't mean necessarily the $8,000, but until we get up to a level, whatever that is in this area, we are going to have problems.

SENATOR SALTONSTALL: Naturally, you have to attract the people. I'll just say there is an old English expression that came during the Industrial Revolution "Where there's muck - there's money" and this meant that where there's air pollution and water pollution somebody is making a lot of money. Now we might say "muck costs money."

CHAIRMAN KLASHMAN: Thank you very much, Senator. I would now like to call on Senator Di Carlo.

SENATOR DI CARLO: Thank you very much, Mr. Chairman. I am Representative Joseph C. Di Carlo of the First Suffolk District and Senator-Elect from the First Suffolk District which takes in the City of Revere, the Town of Winthrop and the Town of Saugus, three vital areas which you are concerned with, Mr. Chairman, in relation to water pollution in the Greater Boston Harbor area. Mr. Chairman, before I present my prepared text I would like to make a few comments or statements on some of the questions that were asked of Senator Saltonstall. I had either the good fortune or the misfortune of serving for the past nine months as Chairman of the legislative committee which investigated the Deer Island Sewage Treatment Plant in an attempt to bring about what we considered solutions to the problem at the time. In regard to some of the comments that were made, I would like to state the one gentleman made the statement that, I believe, it was the Federal government or some agency which was setting forth a program of three one-week sessions in order to prepare certain people as operators of sewage treatment plants. I might say to you quite candidly and quite frankly, that you could have thirty one-week sessions and I don't think it is going to be sufficient. We find that the Deer Island Sewage Treatment Plant in the Commonwealth of Massachusetts which is located off the town of Winthrop, which has now cost this Commonwealth approximately $64 million. It is a most sophisticated plant; a very technical plant, and the main problem that exists there is the fact that we have not been able to acquire personnel to operate it. And the reason being, number one, that it appears that the cart was put before the horse and the fact that it is approximately eight years that plant has been under construction, is not fully operative at this date right now and one of the problems we have is personnel, and it is salaries. We find, Mr. Chairman, that number one, the MDC in the Commonwealth of Massachusetts, which had full jurisdiction over the MDC plant, in stipulating or in setting some of the pre-requisites for job qualifications for a plant of this magnitude, the policy or the prerequisites established were much too rigid for people to apply for these jobs without the proper qualifications. It was only approximately two months ago that the Commonwealth of Massachusetts, through its Department of Administration and Finance and Personnel, established at a cost of $200,000 a program whereby we were taking men and sending them to Neosho, Missouri in an attempt to train them for thirty-day periods to come back as diesel plant operators or electricians or whatever the case may be. When they went to Missouri to be trained and we took them back to the Deer Island Sewage Treatment Plant, we find that this plant is operating on a cycle of twenty-four hours a day. And we are not going to get trained, technical, skilled personnel to go out and to work in a plant at salaries that are far below private industry. There is absolutely no doubt about that. And whether or not it's going to require a subsidy from the Federal Government or from the State itself in an attempt to attract and to draw qualified personnel from Deer Island, it is still a question that is unanswered. And I might say, Mr. Chairman, that already the turnover since the plant has been in full operation in the last six months, the turnover is just fantastic. We find that we cannot draw or attract young men to make a career out of it. The best that we have been able to do is to attract or to acquire people who are retired. Retired from some phase of work similar to the operation out at Deer Island, who are drawing salary on a pension or retirement basis and then to go out and work at Deer Island as a trained technician for a salary that is so substandard in relation to what we consider private industry that it is absolutely unbelievable. Mr. Chairman, I might state that perhaps the greatest experience I've had in the last four years in serving in public office is my affiliation with the investigation of the Deer Island Sewage Treatment Plant. Because its impact on recreational facilities, its economic impact on shellfish areas in the Greater Boston Harbor area has just been tremendous and I might say now, that although the plant is in operation and it is chlorinated, that the problem that we have before us is one that sometimes appears to be insurmountable, and whether or not a solution is going to come about within the near future, I am still perplexed and it is still a mystery. Mr. Chairman, I might state that the shellfish areas of Boston Harbor are classified into three major categories - approved, restricted and closed. Of these three, there are approximately 4,500 acres of shellfish area in Boston Harbor, and of these, approximately 50% presently are closed. They have been closed by the Massachusetts Public Health Council or Agency, 38% are restricted which means that the shellfish harvesting that is done within that 38% area is not to be accepted as edible and 12% of the 4,500 acres actually remain open. Many of the shellfish areas in Boston Harbor are subject to sewage pollution from various sources. The major source of pollution stems from the numerous shoreside combined sewer overflows which number approximately 90 in the Greater Boston Harbor area. These sources of pollution have been in existence for many years and will continue to exist in spite of recent advances and progress made in the treatment of raw sewage from the Deer Island outfall. Mr. Chairman, presently the Deer Island Sewage Treatment Plant is pumping a little better than 300,000,000 gallons of sewage per day. Of that 300,000,000 gallons of sewage per day, I would estimate that now because this plant is operating at perhaps 50% maximum capacity that we are dumping raw sewage into the Boston Harbor area which is affecting the entire Boston Harbor area. Action to eliminate or to control pollution from the combined sewer overflow must be taken in order to protect our bathing beaches and to prevent our shellfish from becoming so contaminated that they can no longer be used for food purposes. In recent years, Mr. Chairman, since 1960, bathing beaches in Winthrop Harbor have been closed to bathing because of sewage pollution stemming from local sources and also from the discharge of raw sewage at Deer Island. I might say, Mr. Chairman, that in the summer of 1968, the Public Health Council or the State Public Health Agency came very close to closing the Revere Beach area itself as a recreational facility and I might say that on a good weekend, there are as many as a half to one million people who use that recreational facility. I sometimes think that the Public Health Council didn't close it but for sheer panic in the minds of people. This year the Deer Island Sewage Treatment Plant was put into operation and I might say but partial operation. And sewage into the Boston Harbor has been receiving primary treatment and chlorination. Joint studies conducted by the Town of Winthrop Health Department and the Massachusetts Department of Public Health during the 1968 bathing season showed the bacterial levels in all but two of the Winthrop beaches were somewhat within the acceptable standards for bathing waters. Consequently, the beaches were reopened for the first time since 1960. This is a tribute to the sewage treatment plant and hopefully progress will be made at other areas, as it must, if man is to continue to use, appreciate and enjoy to the fullest, the great natural resource of the Boston Harbor estuaries. Mr. Chairman, I might interject that the edification of this hearing and for a fact that when we consider the Revere Beach area, the Point of Pines River and the Saugus River, which are tributaries into the Point of Pines

Harbor, we find that the City of Lynn at the present time, in conjunction with General Electric, (which abuts the Revere Beach area in the Point of Pines area) at the present time is pumping raw sewage into that area. I have spoken with the Mayor of that great city on numerous occasions and have asked him what is being done about it. I was advised at the time that it was the Federal government who set about some mandate that by the year 1970 (whether this is fact or not, I don't know), by the year 1970, the City of Lynn was mandated to submit a report. Yes, a progress report in an evaluation as to whether or not they were going to be prevented or restricted or prohibited from dumping raw sewage into the Boston Harbor area as they have been doing for many years. I would only hope again, that I offer this to you in an attempt that in your study with the result that might come about that this may be taken as a word of fact and something might be done with many of the cities and towns, especially a big one or a large one such as the City of Lynn, in an attempt to prevent them from dumping raw sewage into our harbors. The problem of sewage pollution is not restricted to Boston Harbor alone. There are similar problems throughout the numerous estuaries of the Commonwealth. To name a few, we might mention the Merrimack River, Ipswich River, Salem Harbor, the tributaries, Lynn Harbor, the tributaries, Plymouth Harbor, Great Harbor, the tributaries in Falmouth, Mount Hope Bay and many others. In these estuaries there are untold numbers of shellfish which are presently being sacrificed because of direct sewage pollution and a large number of people are deprived of a valuable protein source and food supplement, not to mention the numbers of people who are being deprived of making a livelihood in the shellfish industry. There is no price that one can put on the aesthetic and recreational value of these estuaries. All natural resources which have been despoiled by the activities of man must be rehabilitated and restored to a condition where they will once again be beneficial to all and not to a select few only. Massachusetts must move in this direction and be counted among many other states which are progressing in the area of water pollution control. It has been roughly estimated that the value of a good shellfish-producing area may be placed at about $25,000 per square acre per year. Using this figure, the entire Boston Harbor shellfish area would be valued in the millions of dollars. Presently, the value of shellfish resources in Massachusetts is estimated at somewhere under one million dollars. This will give us an idea of the economical impact which pollution has made on shellfish gaming in the Massachusetts area. Let us remember that as important as shellfish are in the estuarine environment there are numerous other forms of life which depend on this resource for existence. The young of most coastal fish species live in the marshes and very shallow waters along the edges of bays and tidal rivers, where they find protection and food. Scarcity of fish in certain areas has been attributed to pollution and the general disruption of coastal areas. In consideration of the many facets involved in the ecology of an estuary, management practices to best provide for the development and protection of our resources must originate at all levels of government, including Federal, state and local. Mr. Chairman, I would only hope that perhaps my presence or humble offering of some fact or experience that I have had in the last nine months in direct relation to this, I would only hope that for the sake of the many people who are appearing here this morning, that with all due credit to you and your department in the Federal government, that this does not become but another study that will land somewhere on a shelf and at the conclusion of it that you or some Public Health agency may say, "We've added further facts to the problem at hand but now what is going to be done about it?" I think by the mere fact that this hearing is in existence this morning by your presence here that we now at both Federal, State, and I would hope in local government, recognize this problem and in the very near future bring about some type of solution for all of the facts that have been presented here which are detrimental. As I said both economically, recreationally and in every other phase that it affects. Mr. Chairman, thank you.

CHAIRMAN KLASHMAN: Thank you, Senator Di Carlo. I'd like to clarify the purpose of this hearing, which is to collect information which the Congress of the United States can use in developing legislation for the protection of our estuaries. Do you have any questions?

(there were none.)

CHAIRMAN KLASHMAN: I would like to introduce Mr. Zabriskie who is representing Mr. Yasi from the Department of Natural Resources and Mr. Al Peloquin from the New England Interstate Water Pollution Control Commission. Senator Di Carlo, I'd like to just make an observation and perhaps a question to you. You mentioned that the salary levels were inadequate to attract proper people and that possibly a State or Federal subsidy is necessary for the MDC plant. Why can't the MDC plant provide funds from user charges to pay whatever salaries they need. Why must they be subsidized?

SENATOR DI CARLO: I might say, Mr. Chairman, that perhaps the basic problem that exists here is the fact that all of the job titles and positions at the MDC sewage plant now are under Civil Service. Perhaps we might say that this is a subject in itself for total reorganization of salary upgrading of Civil Service. But we find, for example, that a diesel operator at the Deer Island Sewage Treatment Plant who must meet the prerequisites or, that which has been written by the MDC for job qualifications, starts at a salary, 40 hours, at approximately $97 to $111 per week. We find that an electrician starts at a salary under Civil Service, and one who must again meet the prerequisite so established, of from approximately $111 to $122 a week. Now I think that any person today could draw the conclusion very easily that a trained technician, a diesel operator or an electrician who has this kind of skill is not going to go to work under Civil Service whether it be security, fringe benefits or whatever else may go for it for a salary of this nature. Especially where he may be working on a rotating shift of eight hours days, an eight hour midnight shift and an eight hour graveyard shift, and especially, at a plant where again, perhaps the cart was put before the horse, at a plant whose location has no public means of transportation.

CHAIRMAN KLASHMAN: Do you mean that the Civil Service system in Massachusetts is so inflexible that it is impossible to accommodate this type of situation? I know that, for example, in the Federal government, when there is a situation of the sort you mentioned, it is possible for the Civil Service Commission to reevaluate the salary schedule and to adjust it so that it is competitive. Isn't that possible?

SENATOR DI CARLO: No. It couldn't be done under the Civil Service form. The only system we established that could be considered flexible was the fact that certain people were employed on what we consider a provisional basis. Provisional, therefore, you might say, bypassing the Civil Service requirements. But this provisional basis states that a man would go to work for perhaps 90 days or for six months and then at the end of that six months, if, for example, that job qualification were not there or a grade salary was not made appetizing to him and at the end of six months he could be removed or displaced from the job. Therefore no security. This was about the only means that we have.

CHAIRMAN KLASHMAN: Do you mean that the State Legislature is unable to do anything about straightening this out? I mean they have the power, don't they?

SENATOR DI CARLO: We have the power to do that, Sir, but it would take a revising of the entire program. Under our present Civil Service form if a certain job qualification states that he would be hired under a Grade 9 in one department, then he cannot be hired at a higher salary to fill a job rated as Grade 9 at the Deer Island Sewage Treatment Plant.

CHAIRMAN KLASHMAN: Has there been any thought about the need or the possibility of a separate personnel system for the MDC plant?

SENATOR DI CARLO: This is precisely, Mr. Chairman, what is being considered by the Commissioner of Administration and Finance and the Commissioner of the MDC. We would hope that this might be possible.

CHAIRMAN KLASHMAN: You mean that they would propose this to the legislature?

SENATOR DI CARLO: That we would propose that in the ensuing legislative year.

CHAIRMAN KLASHMAN: That is very hopeful. Thank you very much.

SENATOR DI CARLO: Thank you, Mr. Chairman.

CHAIRMAN KLASHMAN: I would now like to call on Mrs. Nelson R. Saphir representing James R. McIntyre, the Mayor of Quincy. Am I pronouncing your name properly?

MRS. SAPHIR: It's close. It's spelled S-a-p-h-i-r, but pronounced like sapphire.

CHAIRMAN KLASHMAN: Thank you, Mrs. Saphir.

MRS. NELSON R. SAPHIR: The City of Quincy, Massachusetts is extremely proud of its historical past, its outstanding contribution to the shipbuilding industry and fortunately we have become aware of our vast contribution to future generations through our valuable natural asset, the estuarine areas.

We once thought the ocean regime seemed to halt at our shores, but within the past few years we have become aware of a vital process, without the aid of man, which continues until it reaches the fresh water. Quincy is rich in these areas.

The City of Quincy is located south of the City of Boston and shoreward of the Boston Harbor Islands. Four years ago this city with its 26 miles of uneven shoreline had over 500 acres of live unspoiled salt marsh supplying nutrients to the estuaries so beneficial to marine life in the ocean. Three rivers, three bays, many brooks and creeks drain the inlands from the Charles River via the Neponset River to Dorchester Bay. The Fore and Town Rivers drain the vast Blue Hill Reservation. If the pollution can be cleaned these estuarines will return to their full productive capacity being twenty times more productive than inland farmland.

It is my opinion, that everyone in the Commonwealth of Massachusetts should become greatly concerned about the protection of these natural resources if a balance of nature and the process of growth are to continue.

Enclosed is a detailed report of the estuarines surrounding the City of Quincy which I hope will be of assistance in your study of this area.

There are approximately 75,000 acres of watershed in the Neponset River basin which is located north of the city and drains Mother Brook, the East Canton Branch River, many creeks and salt marshes including Montclair Marshes, the Charles and Neponset Rivers and empties into Dorchester Bay.

Pollution comes from four sources:

1. Industrial wastes located above the Town of Milton.
2. Sewage overflow from over-used and outdated leaching beds in Foxboro at the State Hospital.
3. Indiscriminating fill placed by thoughtless residents or industry.
4. Residue from oil products.

A dam located in Milton however screens some of this silt and the pollution disappears drastically.

Recommendations for this area should include:

1. Industrial waste controls
2. Sewage correction
3. Education to all concerned
4. Proper regular inspection and maintenance of the entire river.

The watershed basin of the Neponset River abutting salt marshes and estuaries, has immense value for recreation, it is a flood plain district and has tremendous proven value to marine life in Dorchester Bay by a study recently completed by marine biologists. (Jerome, 1968).

Town River located south of Broad Meadows is the drainage basin for elevations in South Quincy quarries abutting the Blue Hills and empties into the Town River Bay.

This river is not polluted from upstream however, oil residue from nearby oil farms on the shoreline is a tremendous problem at times.

The Fore River is the southerly boundary of the city into which the Town River empties.

Pollution comes from three sources:

1. Oil spillage from tankers docking with occasional accidents to hoses.
2. Carelessness of owners of pleasure craft depositing sewage overboard.
3. Indiscriminate filling by residents.

Dorchester Bay lies shoreward of the Boston Harbor. The pollution, as far as this city is involved would come from the Neponset River.

Quincy Bay lies between the drumlin of Squantum and Nut Island. It drains many creeks in the salt marshes and also the West Quincy Hills via the unpolluted Furnace Brook and Black's Creek. The pollution of Quincy Bay does not come from inland sources but is contaminated by some sewage systems and inadequate facilities, and due to change in water currents. Very little oil problem in this bay.

Town River Bay drains into the Fore River. Pollution does not come from inland drainage but is contaminated by tankers at the oil farms, improper disposal of pleasure craft refuse and sewage.

Numerous estuaries are located within the 26 miles of uneven shoreline of Quincy which contribute to the value of the foreshores containing much shellfish with varying degrees of contamination but nevertheless having much greater potential value economically if the pollution was stopped. In 1965 it was reported, a potential of $550,000 annually from shellfish in the Dorchester Bay area and in 1966 it was reported a potential of

$100,000 in the Quincy Bay area. Of course both of these areas are now worth much more due to the loss of many acres of marshland for development.

Value of the estuary: Aesthetically: One must remember that there are 26 states in the country with the uniqueness of salt marshes and estuaries. This priceless heritage should be cherished, enjoyed and appreciated. It is more valuable than the Grand Canyon or the Taj Mahal for it is a living biological complex which can supply future generations with food. The value of an estuary for recreation and for teaching is priceless because of its multiple use, i.e., swimming, fishing and shellfish population.

The best use of our estuaries would be to leave them alone without the aid of man, allow this valuable natural resource to accomplish its reason for being there, to supply food for the food chain.

It is my opinion that such a valuable natural non-renewable resource should have state and Federal protection as any other non-renewable resource with laws strictly enforced to insure the proper management of the tidal system.

Recommendations:

1. A program of education. At once.
2. State and Federal acquisition or protection at once.
3. Proper regular inspection and maintenance of rivers and estuaries.
4. More strict regulations on oil spillage with higher penalties for accidents. Instigate a research program for clean up of oil spillage (thickening agent such as a gelatin to remove oil in solid form).

5. Inspection and investigation of sewage disposal facilities of the cities and towns.
    a. Education and enforcement of present laws of yachtsmen and small boat owners.

CHAIRMAN KLASHMAN: Are there any other representatives or elected officials? If not, I would like to very quickly before the group read some telegrams and letters that we've received. We have written statements which have been promised or are already in our hands. Copies of these, I hope, will be made available to you sometime in the future if you have registered. From the Conservation Foundation, Mr. C. W. Foster, who was formerly Commissioner of Natural Resources in Massachusetts, and the New Bedford Standard Times. I have a telegram here from Senator Brooke which I would like to read to you very quickly.

SENATOR EDWARD W. BROOKE: Gentlemen: Although I am unable to be present at this vital meeting on estuarine preservation, let me assure you that I am deeply concerned over the results of the study now being conducted by the Federal Water Pollution Control Administration.

You are all no doubt aware of the significance of our threatened estuaries. I am increasingly distressed to hear of more and more destruction of these wetlands by the introduction of sewage, pesticides, and indiscriminate dredging. The blame for this full-scale pollution rests equally on Federal agencies, private industry, State and municipal governments, and real estate promoters.

The estuarine resources of Massachusetts yield the Commonwealth over $2,000,000 worth of shellfish each year and also provide an essential stage in the life cycle of many commercially valued fish. In addition, these areas add to the enjoyment of an estimated 35,000 people who shellfish each year in the Bay State.

We cannot stand by while these valuable resources are destroyed for no other reason than to satisfy man's immediate needs. We must plan for the future now.

My best wishes for a productive meeting which I hope will yield many positive solutions to this threatening problem. I look forward to receiving a transcript of your proceedings. Sincerely, Edward W. Brooke.

CHAIRMAN KLASHMAN: We have a letter from Congressman Bates which Mr. Pahren will read. Congressman Bates also sent us a telegram alerting us to the fact that he was sending this to us.

(Letter read by Mr. Pahren)

CONGRESSMAN BATES: Dear Mr. Klashman: At the suggestion of the Office of Estuarine Studies, Federal Water Pollution Control Administration, I am addressing this letter to you in the hope that it will be received in time for inclusion in the record of the public meeting to be held on Tuesday, October 8, 1968, in the Charter Room of the New England Life Building, Boston, concerning estuarine preservation and development problems as part of the National Estuarine Pollution Study. I understand that you are presiding at this meeting.

First of all, I would like to endorse strongly the inclusion of the Merrimack River Estuary in this study. The pollution problems posed by the Merrimack are well known, and the effects of this pollution in the river's estuary are vitally important and merit all possible attention as part of the overall efforts to solve these problems.

Possibly less familiar to you and your associates is a second estuary pollution problem of long standing in my Congressional District. The North River in Salem and Peabody has posed a pollution and odor problem for over 50 years, and it is hoped that plans now being pressed by the South Essex Sewerage District, serving Salem, Peabody, Beverly and Danvers, will ultimately resolve a major portion of this problem. These plans call for a new interceptor sewer from Peabody into Salem and a new sewage treatment plant at Salem, with financial assistance by the Commonwealth of Massachusetts and the Federal Water Pollution Control Administration.

However, it has recently been pointed out to me by Mr. Thomas C. McMahon, Director of the Division of Water Pollution Control, Massachusetts Department of Natural Resources, as follows:

"Unfortunately for the residents in the area who are aggrieved by the odors, even after the North River Interceptor has been installed the odors could continue to persist. While the flooding of that portion of the Harbor might alleviate the situation, there still exists the possibiiity of sulphide gases bubbling up through the water causing obnoxious odors. This has occurred in the Mystic Lakes and in the Charles River Basin. It is possible that the only long-term solution may be the dredging of the area and the installation of a dam. Before any large sums of money are expended, there should be a complete evaluation of the cause and means of permanently eliminating the problem."

The area to which Mr. McMahon refers is primarily the flats at the mouth of the North River where it joins the Danvers River at Beverly Harbor. The condition exists throughout the North River estuary, and particularly the Salem shore of Beverly Harbor, when the tide is out. Swimming is banned and boating is impaired by this condition, and the odor from the polluted flats of the river and its estuary is extremely obnoxious to residents over a wide area. Resolution of this problem potentially has broad economic as well as health and aesthetic values.

It is my hope, therefore, that the National Estuarine Pollution Study may include the estuarine zone of the North River with a view toward aiding in achieving the permanent solution to the pollution and odor problems which local, state and federal sources are so desirous of effecting.

Thanking you for your consideration of these matters, and with best wishes for success in our region's portion of the National Estuarine Pollution Study, I am Sincerely yours, William H. Bates.

CHAIRMAN KLASHMAN: A telegram now from Maurice A. Donahue, President of the Massachusetts Senate.

(Telegram read by Mr. Klashman)

SENATOR DONAHUE: Many thanks for your thoughtful invitation to attend your very worthwhile meeting. However, campaign commitments in western Massachusetts prevent my being with you in person. Certainly the impact of pollution on coastal and estuarine waters deserves our continuing attention and effective action. Be assured of my keen interest in this subject and my availability to be of assistance when possible. Again, many thanks for inviting me to be with you. Sincerely, Maurice A. Donahue President of the Massachusetts Senate.

CHAIRMAN KLASHMAN: I would now like to call on Dr. Dean Bumpus of the Woods Hole Oceanographic Institution. How long is your statement?

DR. BUMPUS: Very short, Sir.

CHAIRMAN KLASHMAN: Would you please come up, then.

DR. BUMPUS: Mr. Chairman, I have three points. Speaking of pollution I would like to say a few points about it. It is not all bad. The addition of nutrient chemicals certainly is beneficial to the growth of shellfish and other marine animals. On the other hand, manufactured wastes are seldom if ever beneficial. However, prior to the release of red acid, iron acid wastes off New York Harbor--there was a great hue and cry that this would be terrible for the sport fishing. Now if the National Lead Company stops emptying lead acid wastes a few miles off Sandy Hook, there would be another hue and cry because the acid ground is one of the best fishing areas off the eastern coast of the United States. Certainly the nutrient chemicals have been most beneficial. Nutrients, that is, from the human wastes, or at least from the shores of the Chesapeake Bay, are said to be beneficial for oyster production. Frankly, I like the oysters from Cotuit rather than Chesapeake Bay, but each to his own choice.

We are currently being faced with the problems of thermal pollution. These big power plants are said to be going to introduce an increase in the temperature. How much, those who made the calculation know better than I. How much of this is really pollution? How much temperature can lobsters, shellfish and other plants and animals tolerate? We really don't know. We know that lobsters with suitable aeration can grow at much higher temperatures than the 70 degrees which seems to be the usual temperature, that certainly fishermen who have been bringing up lobsters from the deep bottom of the ocean up to the surface from beyond the 100 fathom line have had difficulty in transplanting lobsters in the summer time. But George Vandenberg down at Great South Bay and the people down at Vineyard Haven, in their lobster hatchery there, have found the lobsters tolerate much higher temperatures than 70 degrees. I certainly would like to state that we need more careful evaluation as to the good and bad effects of pollution.

My second point might be to paraphrase the remark about the moon and the deep ocean, and that is, we know a lot more about the deep ocean than we do about our coastal waters. Our coastal waters have maximum temperature ranges, maximum ranges in salinity, in oxygen, in nutrients; and the characteristics vary largely from place to place. There certainly needs to be a lot more research into the physical and chemical characteristics of our estuarine waters. I would think that the Commission certainly should commence some means of indexing what is already known to see that this is on file in some common source such as the National Oceanographic Data Center, or whereever the need for this information is available, because those people who are faced with the problems of thermal pollution need to know in detail what is the annual cycle of temperature at a given location. We really don't know in adequate detail enough to really evaluate what the effect the power plant is going to be. There is a big industry for Irish Moss right down here where there is going to be a new power plant. What kind of a temperature range can Irish Moss tolerate? Is this power plant going to ruin any industry or isn't it? I think this is the kind of thing that we can find out very quickly.

My third point, Sir, is that the Massachusetts Association for Marine Science, which is a group of New England colleges, Massachusetts colleges, are beginning to file courses in oceanography into their curriculum. Oceanography doesn't have to be an expensive science. I am sure that at the next meeting of this group which will occur early next month, we are going to be able to show the leaders in these colleges and universities how they can go to work to help you solve some of your problems in Boston

Whalers with students and the usual laboratory techniques. I think there is hope, very definite hope, that you can get some assistance for these people and also include the educational aspects of this program which is recognized as well. Thank you.

CHAIRMAN KLASHMAN: Dr. Bumpus, is that Dean Bumpus?

DR. BUMPUS: That is my first name.

CHAIRMAN KLASHMAN: Do you have any questions, gentlemen? I would just like to ask you a question relating to this statement of yours that the dumping of the acid waste in the New York Bight is beneficial to the fishery there? We took testimony from a number of people and we had conflicting evidence. I have fished there myself so I am aware of the fact that there are fish and very good fishing, but there was some indication the fish were tainted. The problem that you speak of, of course, is much greater than just the acid mine dumping. Do you have any thoughts about the idea of dumping industrial and organic wastes in the sea? Is it safe in your opinion to dump them ten miles off the coast?

DR. BUMPUS: Moran Towboat called me a couple of months ago and were hoping to contract with a city near New York to carry several thousand tons of domestic and all kinds of rubbish out to sea every week or so. How far should they go? They suggested they might go as far as Hudson Canyon. And I said, "If your skipper can bring back a fathometer record that he has been to 100 fathoms each trip, it's probably not a bad idea. But six miles off shore...how the people on the coast of New Jersey can swim, I don't know. I think you can dump some things into the sea. Yes.

CHAIRMAN KLASHMAN: But the problem that I raise to you again, if we indiscriminately continue to dump, with our growing population on the earth, isn't there a danger that we are going to start destroying some of the fishery areas?

DR. BUMPUS: It depends on where you dump, how much and what you dump. You certainly can't dump indiscriminately, I agree.

CHAIRMAN KLASHMAN: Well, how do you determine? What is happening now is that Moran says to you can they dump ten miles off shore?

DR. BUMPUS: No, not ten miles off shore. The head of the Hudson Canyon. I said if he can go to 100 fathoms, and that's nearer 80 miles off shore, near the Texas Towers. That would not be in an area that is presently fished. It is not an area where we know of any potential fish source. There are lobsters both north and south of this. But it is going to be expensive.

CHAIRMAN KLASHMAN: Would it be unreasonable to require people to go off the shelf with toxic material?

DR. BUMPUS: Not at all. I would think it would be most hazardous to dump toxic materials on the continental shelf.

CHAIRMAN KLASHMAN: Now how do you tie this into your...off the shelf you mean?

DR. BUMPUS: Yes, Sir. No, it would be most hazardous to dump toxic materials on the shelf.

CHAIRMAN KLASHMAN: Yes, I said it should go off the shelf.

DR. BUMPUS: Correct.

CHAIRMAN KLASHMAN: How do you tie this with your thoughts that the acid lead dumping is...

DR. BUMPUS: Well, before they did it, I certainly thought that this was not a palatable thing to do, and certainly the sports fishermen along the New York-New Jersey coast were very vociferous about this. I understand today, that they are just about as vociferous in favor of it. I think again, this could use more evaluation. This is the first time I heard of fish being tainted.

CHAIRMAN KLASHMAN: This was about ten years ago that we had a hearing on this, and as a result of this we have been taking a very careful look at any request.

DR. BUMPUS: Frankly, I think its a little close.

CHAIRMAN KLASHMAN: Thank you very much, sir. Before I call on the next speaker, I would like to introduce Mayor Francis Collins from Salem. Is he here? I am glad you're here with us, Mayor Collins. Is there someone representing Senator Moakley here? We just wanted to recognize that the Senator was represented. I would now like to call on Mr. David Mofenson, who is the Democratic nominee from the Thirteenth Middlesex District. Mr. Mofenson, do you have a prepared statement?

MR. DAVID MOFENSON: Yes, I do.

CHAIRMAN KLASHMAN: You'll be able to leave a copy with us?

MR. MOFENSON: Well, I suppose I could.

CHAIRMAN KLASHMAN: Thank you.

MR. MOFENSON: I am David Mofenson, Democratic candidate for State Representative from the Thirteenth Middlesex District, Newton.

I thank you for giving me this opportunity to speak here this morning.

We in Newton recognize the historical importance of the Charles River. Like it does to many other cities and towns, it cuts through the heart of our city, and has given to us much of its rich legacy. One of our main streets, Quinebequin Road, is named after the Indian name of the Charles

River. It means "winding river." Where quiet residential areas are today, Indians hunted and roamed through the woods. From the banks of the Charles, they caught their fish. In every way, the river was part of their lives. They asked much of the river, and it gave much. The river was their sustenance, but take from it as they did, the river was passed on to us, unspoiled. We are all mindful, today, of how that rich legacy has been dissipated, how the present has betrayed a great and transquil past. Into the Charles, stretched as it does through 307 square miles which make up the watershed, we have dumped our junk, spread our debris, spewed out our wastes. It is somewhat akin to dumping rubbish in the streets--only we dump it into the river. Today, in many areas along the Charles, picnickers can no longer eat by its beautiful banks. Swimmers can no longer swim and wildlife is not as plentiful as it was. Here where there is unparalleled opportunity for vision, we have tolerated blindness. Here where there is potential for undreamed of grandeur, the grandeur of old has been despoiled. This river can enhance everything it touches. To do so, it needs the respect that it is owed. The river has great recreational potential. It can be a haven for boating, for picnicking, swimming, fishing, wildlife, hiking. It can be landscaped, its beauty can be enhanced, its banks made more accessible. It has been said by the Charles River Valley Group League of Women Voters that "....quite apart from active recreation, the Charles River can increase its value to people as a place to work, to study and to live." This river can be an asset to real estate values but it can be more than that. It can improve the quality of our lives. It is truly one of our most important continuing responsibilities. I urge that necessary treatment works be installed as quickly as possible. I urge coordinated and concentrated action be taken now. I urge better control of land use, better and more waste disposal and treatment plants. I urge more inter-town cooperation. I urge that our dedication to this task be renewed now. Only in this way can this river be restored to its former greatness. Only in this way can we remain true to our heritage. Thank you very much.

CHAIRMAN KLASHMAN: Thank you very much. Did you say you had a prepared statement?

MR. MOFENSON: I will prepare one.

CHAIRMAN KLASHMAN: Thank you. Do you have any questions?

I am now going to call on Mr. Irwin Alperin and following him we are going to hear from Mr. Morgan of the Audubon Society and then from Mrs. Bates from the League of Women Voters. While Mr. Alperin is coming up, Mr. Zabriskie, do you have three of your division chiefs here? Would you mind introducing them?

MR. ZABRISKIE: Mr. Chairman, members of the panel, on behalf of the Department of Natural Resources, Commissioner Yasi, His Excellency the Governor, we are pleased to participate in this program. It's very vital and necessary and it's a continuing thing. This morning representing the Department - Mr. Alperin, who is an Assistant Director of the Division of Marine Fisheries, Director and Chief Engineer, Charles Kennedy from the Division of Water Resources is present; and Thomas McMahon, Director of Water Pollution Control has his representative present here this morning. They are to my right. Mr. Kennedy and the representative from the Water Pollution Control, will you stand and be recognized.

CHAIRMAN KLASHMAN: Thank you very much. Do you have a prepared statement?

MR. IRWIN M. ALPERIN: Yes I do, Mr. Chairman.

CHAIRMAN KLASHMAN: May we have it when you are through?

MR. ALPERIN: It's a brief statement. I may preface this by saying that the publications that I have reference to here have been made available to the Water Pollution Control Administration and to the public and other agencies that are interested in this type of work.

CHAIRMAN KLASHMAN: Thank you very much.

MR. ALPERIN: The Division of Marine Fisheries of the Department of Natural Resources has an almost proprietary interest in the estuaries and estuarine areas of the Commonwealth. In January 1963 a preliminary report on the coastal wetlands was published, Senate #635, a report of the Department of Natural Resources relative to the coastal wetlands of the Commonwealth and certain shellfish grants. The report pointed out in general terms the value and importance of these areas and the need to protect them. A year later, in January 1964, the Division of Marine Fisheries produced a more definitive report, Senate #855, reported to the Department of Natural Resources relative to the coastal wetlands in the Commonwealth. The report documented key values of the coastal wetlands, denoted priority of marginal areas and suggested a number of ways of safeguarding estuarine areas, including the need for pollution abatement.

In June 1963 the Division began an estuarine research program to study and evaluate the marine resources of selected estuaries and coastal bays of the Commonwealth. To date, fourteen such areas have been investigated. Within each area, the status of the past and present fisheries has been delineated and an evaluation of the physical, chemical and biotic characteristics of the ecosystem has been made. The areas in which this Division has worked, and the status of each report, is listed below.

There are five published reports: The Study of the Marine Resources of the Merrimack River Estuary, The Study of the Marine Resources of the North River, The Study of the Marine Resources of Quincy Bay, The Study of the Marine Resources of Beverly-Salem Harbor, and The Study of the Marine Resources of Pleasant Bay.

We have, in addition, two reports in press: The Study of the Marine Resources of the Westport River, and The Study of the Marine Resources of the Parker River-Plum Island Sound Estuary.

In addition, two manuscripts are in the process of being written: The Study of the Marine Resources of Waquoit Bay, and The Study of the Marine Resources of Annisquam River-Gloucester Harbor Coastal System. The field work has been completed and preliminary reports prepared on two additional areas: The Study of the Marine Resources of the Wareham River Estuary, and The Study of the Marine Resources of the Plymouth-Kingston-Duxbury Harbor.

Field work has been completed on an additional area in preparation for The Study on the Marine Resources of Dorchester Bay.

In addition to that, our estuary teams are now out doing field work in two different areas for a Study of the Marine Resources of Welfleet Harbor and finally The Study of the Marine Resources of Lynn Harbor.

Each of these reports touches on pollution and its effects, both direct and indirect, on marine resources within the described area. Recommendations frequently include measures for pollution abatement.

Thank you.

CHAIRMAN KLASHMAN: Thank you very much, sir. Are there any questions?

MR. PAHREN: I have a question, Mr. Alperin. Based on your studies of the estuaries of Massachusetts, do you have any views on what system of management might be best to protect estuaries for the future?

MR. ALPERIN: Well, we have been working, actually in Massachusetts, at a system that enlists local aid, we have state jurisdiction in some areas, we have within the framework of the law under which the Division works, the estuary protection acts. I think that our general opinion would be that it has to be a combination. That no agency does it alone. It has to be state, federal and local participation. I think that our studies at this point, really, have the most definitive collection of information that any state has on its estuaries, perhaps there may be one or two individual places in the United States that have been studied in more detail, because we have so many estuaries that we wanted to gather some information about, we have undertaken this inventory by spending only a year in each area. Actually, those people who are familiar with it know that the estuaries are so complex they probably could spend ten years in a place and not have the total information, but we feel that this input can then be used by other agencies, other agencies in our own department and by the Federal agencies in coming up with comprehensive management practices for individual estuaries.

MR. PAHREN: Do you believe that the system of zoning or some other arrangement is necessary?

MR. ALPERIN: I don't think we have come to this conclusion yet. But I should envision that this is a possible way of approaching it. I think what is more important though, is those estuaries that are relatively unspoiled and have a minimum of pollution or other interferences in their natural systems, must be protected in their entirety right now. Because I think that they represent things that will not exist much longer, particularly in the industrialized area.

MR. ZABRISKIE: Mr. Chairman, if I may. We have many acts in the Commonwealth within the past six to eight years that makes Massachusetts a leader in conservation. We have the so called Chapter 13027A, the so called Jones Act, that makes it mandatory that developers along our coastal estuaries, along our shores, that is, land in the tidal waters of the Commonwealth apply through the Department of Natural Resources, the Department of Public Works and the local towns on any alteration of these lands. This is going on now. We also have Chapter 768 of the Acts of 1965 which provides that the Department of Natural Resources go along the coastline of the Commonwealth and set down, if you will, zoning restrictions. This is to restrict the use of the land mass along the coastal area of the Commonwealth. At Castle Point, town of Ipswich, the Department of Natural Resources held a public hearing and restricted the use of 3,700 acres of estuaries or coastal wetlands. This is a matter of fact. It's recorded with the Salem Registry of Deeds. We have in the Commonwealth of Massachusetts, again Mr. Chairman, at my last count, 274 conservation commissions. And to say that we have a pipeline from the local communities to the Department of Natural Resources and other State departments would be putting it mildly. Very vocal, very active - and the results of all this is that the Executive Department, through his Excellency the Governor, the legislative body in Massachusetts are kept informed. These are non-partisan issues and the proof is in the pudding. Also the law enforcement takes its part. At the present time, the Attorney General makes at least three and sometimes ten of his assistant attorneys general available to the Department of Natural Resources, almost on a daily basis. So the laws are there, and they are being put in effect. However, in carrying out the programs, it's the wise use and the wise delivery of these programs that are so important. If a city or town on the coastal areas of the Commonwealth does not move in this respect, the Commonwealth has the right, in fact, has a mandate of the Legislature to proceed. We are doing just that now. In fact in acquiring land in these estuaries, last year there was an amount appropriated by the General Court of $700,000 and every dime of that $700,000 was spent and spent wisely. The General Court in the last session in Massachusetts appropriated $1 million for the next twelve-month period and spelled out legislation culminating in new state programs. In keeping with the U. S. Department of Agriculture, Soil Conservation Service, we have very active and vital programs. Also on the Federal level, the Department of the Interior, Bureau of Outdoor Recreation, the Commonwealth of Massachusetts will expend $2,200,000 within the next ten months. Again, the criteria from the Federal government is that 2/3 of these funds be spent for land acquisition, 1/3 in development and the standards, or the priorities by our plan. As far as recreation (or state wide plan of recreation), water oriented recreation has top priority. So Mr. Chairman, rather than spell off some notes that I have here, I think it would be much better for me just to sit and receive and hopefully interject a thought once in a while.

CHAIRMAN KLASHMAN: Thank you very much. I would now like to call on Mr. Morgan. Mr. Morgan is the Vice President-Treasurer of the Massachusetts Audubon Society. As you know, we are limiting the statements to ten minutes. Mr. Morgan, however, is also going to speak for the Massachusetts Conservation League, is that correct?

MR. ALLEN H. MORGAN: The Council, Mr. Chairman.

CHAIRMAN KLASHMAN: Thank you very much, Mr. Morgan.

MR. MORGAN: Thank you very much, Mr. Chairman. I hope I won't take all of the time that is allotted to me. I have a series of slides. It has been suggested that it might be well to set the tone with some actual photographs of these areas in Massachusetts. Do you want to see those now?

CHAIRMAN KLASHMAN: Yes, we would like to. We could run through them. While he is getting ready, I have a letter from a Henry D. Russell which I would like to read to you.

MR. HENRY D. RUSSELL: As a marine biologist, I consider that the value of our estuaries is almost inestimable and begins with the marshes along its banks. These produce the rich nutrients that initiate the food chains from protozoans and diatoms to crustacea that feed on them to small, and later, larger fish forming our coastal and offshore fisheries. They are also extremely valuable as:

1. Brood areas for larval forms of fin fish and shellfish in the broad sense.
2. For growing areas for these young forms until they join

the adult populations.

3. As resting, feeding, and brood-rearing areas for shore birds and waterfowl while migrating or not.
4. As human outdoor recreational areas for boating, swimming, water-skiing, etc.
5. As aesthetically beautiful, spirit-refreshing sources and artistic inspiration.
6. As coastal protection from storms for shipping and yachting.

For these reasons, I feel that our coastal estuaries are a priceless heritage that should be carefully guarded and passed on as natural a form as possible to future generations for their use and enjoyment. Respectfully submitted, Henry D. Russell, PhD.

CHAIRMAN KLASHMAN: Go ahead, Mr. Morgan.

MR. MORGAN: Thank you very much. We can have the lights out. It might be well, although most of us I am sure are very well familiar with the coast of Massachusetts. I thought I would run through quickly a series of color slides showing some representative areas of Massachusetts coastline. The coast of Massachusetts is a popular place through every season of the year.

(Mr. Morgan shows slides).

To invite a Massachusetts naturalist to comment upon the values and abuses of Massachusetts estuaries lays one open to a potentially endless harangue. There are whole books written upon the subject and skeins of salt marsh and estuary use and abuse thread through thousands of histories and novels dealing with early Massachusetts. It is not our intention at this time to create another lengthy tome. We would, however, call the hearing officers' attention to a few fragmentary highlights of the

Commonwealth's estuarine record.

An anthropologist skilled at removing the romanticized history that overlays our Pilgrims and Puritans would correctly classify those early settlers as "estuarine peoples" and identify their early modes of survival as "an estuarine culture." They settled where rivers join the sea. They harvested salt grass for scores of uses, ranging from roofing for their homes to bedding for their cattle. Like the Indians whose estuarine culture they were replacing, the early settlers depended heavily upon the finfish and shellfish they found both plentiful and easily-reachable in the estuary.

As Francis Higginson, who sailed from England in 1629 to become Salem's first pastor, commented in his "New-England Plantation": "The abundance of seafish are almost beyond believing, and sure I should scarce have believed it except I had seen it with my own eyes.....abundance of lobsters and the least boy in the plantation may both catch and eat what he will of them. For my own part I was soon cloyed with them, they were so great and fat and luscious...Also here is abundance of herring, turbot, sturgeon, cusks, haddock, mullets, eels, crabs, mussels and oysters."

Thomas Morton in his "New England Canaan" of 1634 gave a lengthy account of innumerable finfish that abounded near Mount Wollaston, now part of the Quincy Bay shore, and said of shellfish: "There are great store of the oysters in the entrances of all rivers....Clams is a shall-fish....These our swine feed upon and of them there is no want..."

To speak of ancient and sketchy records may seem irrelevant to a hearing in 1968. These fragments from the past do, however, establish the potential of estuaries. They offer assurance to this hearing that those who would restore some degree of health to the estuaries are dealing not with fantasy but with material things that have existed. It offers a measurement of how far we have traveled from home base.

One can find in Massachusetts far more recent records of shellfish abundance in the estuaries. For instance, in 1903 some 125 men were employed the year-round in Newburyport digging and shucking clams. A report in a Newburyport newspaper of January 31, 1903, stated that an average of 725 gallons of shucked clams were shipped each day from Newburyport to Boston. At that period the American Express Company had four teams and drivers picking up the daily clam harvest at Newburyport and another team serving the nearby Salisbury flats.

Within the memory of living men a sizable steam fleet harvested oysters off the southern Massachusetts and Rhode Island estuaries.

It is not our purpose to condone over-exploitation of shellfish. We mention these examples merely to illustrate what the potential has been, and continued to be, until recent years.

Today, 90 per cent of the shellfish beds from Boston north to the New Hampshire line are contaminated by human sewage and industrial waste--much of it disgustingly so. In fact, we often have suggested publicly that a few of these tidal cesspools may be an open menace to human health.

Today, oysters in Massachusetts exist mainly in fond memory. The production of oysters along Cape Cod has declined 82 per cent in the past fifty years!

Agencies concerned with estuarine pollution will find available in Massachusetts several excellent and recent documents that have resulted from extensive research carried out by the State Division of Marine Resources. We recommend that extracts be made for the record from "A Study of the Marine Resources of the Merrimack River Estuary" (Massachusetts Department of Natural Resources Monograph No. 1: June, 1965); "A Study of the Marine Resources of Quincy Bay" (Massachusetts Department of Natural Resources Monograph No. 2: March, 1966), and "A Study of the Marine Resources of the North River" (Massachusetts Department of Natural Resources Monograph No. 3: May, 1966).

The Commonwealth of Massachusetts has passed laws curtailing the physical destruction of salt marshes by dredging and filling. These laws will have little more reality than poetry unless strong measures are taken to halt sewage, industrial and chemical pollution that unquestionably are killing the estuaries that the marshes border. Where the river meets the sea, all the abuses of the river become stacked. The old idea that instant dilution occurred in the estuary has become a myth that one's own nose can dispel in many estuaries.

The introduction of chemical poisons into estuarine areas has cut levels of productivity. Research has shown that a concentration of .007 parts per million of DDT will reduce the growth rate of oysters to one-half normal in ninety-six hours. Endrin at .0006 parts per million will cause death or paralysis of fifty per cent of a shrimp population exposed for twenty-four hours.

These are just two examples of the catastrophic potential inherent in the accumulation of commercial poisons--and all evidence points to the fact that pesticide levels are reaching critical thresholds in many Massachusetts coastal areas. Pesticides, like solid wastes, are injected into the coastal environment both directly and indirectly. Persistent chemicals applied to a roadside or a farm field are often carried to estuarine areas by runoff, wind drift, or in the bodies of living things that utilize coastal waters in their life-cycles. These same chemicals are often used in salt marsh mosquito control operations and so-called "weed-control" programs in coastal wetlands.

In the matter of hard pesticides, Massachusetts has made recent progress. Most mosquito-control operations in this state today avoid hard pesticides. It would be wise to ban hard pesticides in estuaries as a federal policy. A dramatic example of recovery, or apparent recovery from hard pesticides, is the Westport River of southeastern Massachusetts, a tidal river that has such a limited watershed that it might be classified as an estuary rather than a river. Three summers ago, Massachusetts banned the use of hard pesticides in the Westport watershed because the once-large osprey population along the river was near extirpation. This summer for the first time, the ospreys have shown signs of recovery. From 48 eggs, 30 ospreys hatched and 22 survived to fledging. In 1965, 40 eggs hatched into nine young, only five of which were known survivors. In 1966, 52 eggs hatched nine young, five of which were known to survive. In 1967, 30 eggs produced eight young, six of which survived. So, it would appear that the astonishing hatch of 30 young and 22 survivors in the past summer indicates a dramatic reversal--a reversal which may be attributed to saner pesticide policy in the watershed.

The case against hard pesticides has been well presented and we needn't utilize this forum for its enumeration. Let it suffice to say that persistent pesticides are polluting our estuarine areas significantly.

It is logical to assume that further research must be undertaken to seek a better understanding of our estuaries. But we have learned enough already to know that these areas are vitally significant. Of immediate need are more comprehensive legal means to halt degradation. This is not an easy task. There are many who would stand in the way. But we have always felt that a long-term consideration such as the future productivity of our New England coast, holds precedence over the short-term interests of a few individuals who would hasten the destruction of our estuaries for personal gain.

The National Estuarine System concept has merit if it will guarantee absolute protection for the areas of concern. We have seen protective legislation in the past which crumbled to dust under a burden of "exceptions" and "allowances." This type of legislation does more harm than good.

A sound system on a national level could be the most effective guardian against needless filling, dredging and depletion of estuarine areas.

But what of pollution? Certainly, any comprehensive program would have to protect estuaries from dumping and direct sewage input. We feel that a good program should also place controls on the use of persistent chemicals on or near protected estuarine waters.

These measures would take giant steps toward insuring the continued productivity of our estuaries but the ultimate answer lies even beyond the narrow strip of coast land. It is found inland at every factory which flushes raw effluent into a river, at every municipal sewage outlet, with every citizen who chooses dangerous pesticides over safe ones. Until these abuses are controlled, our estuaries, indeed our entire environment, will never be secure from further loss of quality through pollution.

CHAIRMAN KLASHMAN: Thank you very much, Mr. Morgan. Do you have any questions?

MR. PAHREN: Yes, I have one. Mr. Morgan you indicated that there is a need to protect the estuaries in the future through adequate legislation. Based on your experience with estuaries, what system of management would you recommend to the Congress to protect not only Massachusetts estuaries but all the estuaries of the country? Do you have any thoughts on that?

MR. MORGAN: The only thought I have is a very negative one. I've had virtually no experience in drafting legislation and what little experience I've had in watching some legislative acts in process convinced me that it is a terribly difficult thing to draft adequate legislation. And because the impact on an estuary can be so far removed from the estuary itself, I frankly don't know. I think it is a tremendously complex task. You take the Newburyport River estuary, it receives pollutants from the headwaters of the Merrimack River a good many miles away. I have no specific recommendations relative to legislation because I don't feel this is within my area of competence.

CHAIRMAN KLASHMAN: Are there any other questions? As I told you before, Mr. Morgan, when I read your statement, I think it reads like poetry. I would now like to call on Mrs. Bates from the League of Women Voters. Mrs. Bates.

(Mrs. Roger Walke read statement for Mrs. Bates.)

MRS. WALKE: Mr. Chairman, we thank you for the opportunity to speak. Mrs. Bates is sorry but she had to leave. I am Mrs. Roger Walke, Chairman of the Water Resources........

MRS. HOWELL A. BATES: I am Mrs. Howell A. Bates, president of the League of Women Voters of Massachusetts, representing 13,000 members in 100 local leagues in more than 130 cities and towns in the Commonwealth. The League of Women Voters has been concerned with the problem of the pollution and conservation of water since 1956. Many of our members live or vacation in estuarine areas. All of our members, through study on national, state, and local levels, are aware of the necessity of protecting our water resources. The League of Women Voters has been in the lead in informing the public of the problems and in supporting sound legislation that would bring a better supply of clean water.

While we do not speak as technical experts in hydrology, we are aware of the dilemmas posed by the apparently conflicting claims of conservation, industry, and human need. I use the word "apparently" advisedly. For example, tourism, the number two industry in Massachusetts, presents us with a dichotomy. Dredging and filling projects to provide waterfront real estate; roads, parking areas, private and commercial boat basins, sandy bathing beaches, and mosquito control bring immediate satisfaction to those who are involved with the tourist trade, while at the same time the damage over the years can result in the loss of the very attractions which brought tourists to our state in the first place.

We are also aware of the effect on our fishing industry, both commercial and recreational, of dredging, landfill, and the use of rivers as sewer lines to the sea. We know that estuarine areas are a natural hatchery for fish, as well as a natural habitat for waterfowl and other game. We know that the loss of even one estuary is not only irretrievable, but places stress on other areas.

We take pride and gratification in the knowledge that Massachusetts has taken a lead among coastal states in protecting its miles of coastline and estuaries. A scientific study by the Massachusetts Department of Natural Resources, combined with strong support from citizens and legislators, resulted in the passage in 1963 of the Coastal Wetlands Act, which requires "proper notification to local and state licensing agencies by petitioners seeking to alter shoreline areas; the holding of a local hearing on such proposed projects." In 1965 a supplementary act was passed which gave the Department of Natural Resources additional authority by providing for state acquisition by eminent domain and for compensation to the owner.

The League of Women Voters of Massachusetts respectfully recommends to this committee that it include in its final report, as a model for other states, a study of the legislative steps that this Commonwealth has taken to protect and preserve its water resources. In addition, recognizing that a proliferation of agencies leads to confusion and inefficiency, we would also like to recommend that this committee examine the desirability of regional zoning in coastal areas, interstate cooperation with built-in methods of compliance and enforcement and the addition of trained conservationists and biologists to the personnel of licensing agencies.

CHAIRMAN KLASHMAN: Thank you very much. Are there any questions?

MR. PAHREN: I would like to find out some information on your last paragraph where you recommended that we look into the legislation Massachusetts has taken. Mrs. Walke, we have a public administration case study under way, whereby we would get the information that went into the passage of the legislation in Massachusetts and this, hopefully, will be used as a model for other states in their legislation. So we are happy that you pointed this out to us.

MRS. WALKE: Thank you very much.

CHAIRMAN KLASHMAN: Thank you again. Dr. Moore, Assistant Professor, Salem State College.

DR. JOHNES K. MOORE: My name is Johnes K. Moore, I am Assistant Professor of Biology at Salem State College and I am an academic chief trainer and oceanographer.

This statement will be limited to pointing out a potentially important study project available in the coastal waters around Salem, Massachusetts.

One important source of potential pollution is that emanating from electrical power generating plants in the form of thermal effluent. Virtually all conventional and nuclear-powered electric generating plants are located on rivers or estuaries where there is a good source of water which is used to cool their condensers. The water, thus heated, is generally discharged back into the environment and forms what is called "thermal effluent". This water is generally free of pollutants of the kind normally associated with the word, but is several degrees warmer than the ambient water temperature.

There has been considerable attention paid in the past two years to the possible effects of this warmer water on the immediate environment and its biological components. Some of these effects have been shown to be detrimental; whereas, some have actually benefitted the local environment.

In Salem Harbor there exists a major generating plant of the New England Power Company which pumps a large amount of warm water into the harbor daily. This is not a new situation, nor is it one of which the public is unaware. Nor is it apt to disturb many biological regimes in the adjacent harbor where raw sewage from industry and home has been dumped since the days of the sailing ships.

I am suggesting that this warm water could be viewed in itself as a resource. It takes a considerable amount of energy to heat water, because of its high specific heat. To release it carelessly to the environment may be a foolish waste.

It just so happens that no more than 500 yards from this generating plant lies the Cat Cove marine research facility presently being built by the Mass. Division of Marine Fisheries, which will be joined hopefully in the future by a joint marine facility of the State Colleges. The interesting and pertinent thing about Cat Cove is that it is essentially a multi-acre impoundment separated from the harbor by a concrete and stone dam through which tidal water passes by means of control gates.

It would seem entirely feasible from an engineering point of view to direct at least some of the warm effluent from the generating plant's condensers into the impoundment in order to raise the ambient temperature of the pool. With some relatively simple control features, a constant temperature could be maintained in the pool on a year-round basis.

My interest in a temperature-controlled impoundment is not one of year-round recreation. Rather, I see an incredibly useful device for broad scale experimentation in what is popularly called "aquiculture" or "mariculture". The commercially important shellfish species of the State require relatively warm temperatures in order to spawn and the growth of adults is almost entirely limited to the warm summer months. By being able to manipulate the temperature of the water beyond small laboratory-sized experiments, we would be taking a major step toward developing successful aquicultural techniques which many of us feel are going to be of such importance to this country and the world in the years to come.

The Division of Marine Fisheries of the Department of Natural Resources has shown great insight in planning their laboratory to do just this sort of large scale experimentation within the Cat Cove impoundment; but, I must add, with no more temperature control than what imprisoning the tides can achieve. If there has been serious consideration of using the warm water effluent from the generating plant, it is not apparent.

I suggest that the National Estuarine Pollution Study urge such warm water producers as the New England Power Company to work closely with the appropriate State fish and game and agriculture groups to see if such cooperative arrangements might be practical to both sides; with constructive steps toward developing marine resources being the public's gain, and the enhancement of their public image being the utility's gain. Such cooperation between public utilities and research institutions is not new and is being considered and even accomplished in several instances. That ends my prepared statement, Mr. Chairman, if I may direct my attention to one other point. And that is, I would like to say a word about the importance of each ecological principle here. In our talks about sewage treatment plants, I think it is frequently ignored. For example, Winthrop Harbor's problem is with the hydrogen sulfide. Perhaps it will not be solved with sufficient operations of the sewage treatment plant, simply because these treatment plants do not remove the nutrients. By this I mean the phosphates and nitrates on which plant matter is so highly dependent. And so I would like just to enter a plea here for public education--in ecology especially; ecology in its most sophisticated term. Thank you very much.

CHAIRMAN KLASHMAN: Are there any questions? I would now like to call on Dr. Harleman of Massachusetts Institute of Technology. Dr. Harleman, do you have a prepared statement?

DR. DONALD HARLEMAN: No, I'll give you one later.

CHAIRMAN KLASHMAN: Fine. Thank you very much.

DR. HARLEMAN: I appreciate the opportunity to speak as a representative of MIT in order to express our interest and technical cooperation and education in the local and national level in the areas of pollution control technology, especially those associated with the estuary and coastal areas. I am a professor in civil engineering and associated with the hydrodynamics and water resources division of that department and in charge of research and teaching in the water quality area. In terms of the stated purpose of this conference, I would like the record to show that the University research grant program of the Federal Water Pollution Control Administration has, in my opinion, been one of the most effective programs in advancing our ability to deal with pollution problems. This program, as many of you know, was initiated many years ago under the Public Health Service and a few years ago, upon the formation of the FWPCA, was transferred to that organization. I would urge the Congress to continue to support, hopefully at increasing levels, this type of university research program. Many of you may not realize that I think you get double-duty for funds appropriated under this program because not only is useful research accomplished, (and I think I can attest to the fact that useful research in terms of application has been accomplished under this program, obviously not only at MIT but at many other universities), but at the same time funds provide the mechanisms of attracting engineers into this field of technology and especially at the graduate level where today there are many funds available and there is a degree of competition for graduate students. It is important to have programs which attract people into the areas that they wish to build up so that while the research is being accomplished we are also providing the means for advanced education and increased numbers of engineers trained in this area. MIT, in particular, has had a long history of education and research in the field of pollution. During the past ten years, the emphasis has shifted somewhat from what previously was treatment plant technology to what might now be called disposal technology. In other words we are actively engaged in developing analytical techniques for styling the fate and effects of discharge into rivers, lakes, estuaries and coastal areas. This is important, I feel, and I don't mean to diminish the importance of treatment plant technology but a great many other universities are doing an excellent job in the area and only about a few are doing very much in the area of disposal technology and I think only by demonstrating quantitatively the effects of increasing treatment, that is, if you increase the treatment from a 60% level of organic removal to 80 or 90% level, (we have, I think, the technology to do this) but in order to accomplish the expenditure of funds to do this we have to show what the effect will be upon the river, estuary, or coastal area. And it is this area in which we are currently devoting a great deal of attention. At the present time, one of our research programs supported by the Federal Water Pollution Control Administration is studying the fate of pollutants discharging in the Potomac and James River Estuary, both of which are tributaries of Chesapeake Bay. These areas were chosen because a large amount of good field data is available in order to test the analytical techniques. We're using high speed computer technology to solve the complete momentum and mass balance equations for chemical organic pollutants and dissolved oxygen. In order to give a description of the water quality parameters, the variation of dissolved oxygen along the estuary as a function of time and distance in the tidal cycle, for multiple interpolations and by this means we hope to show that if one area is improved in organic removal, what effect will this have in other areas and how can you justify the cost and expenditure. Previous methods of dealing with these complex estuary problems have generally ignored the tidal motion and considered only the net fresh water flow through the estuary, and these are clearly not adequate for the complex, multiple point, flux problems that we have to treat today. In terms of local problems, briefly, this summer a group at MIT began to study the effect of population development in Boston Harbor, the effects of increase population level of filling some of the areas between some of the smaller islands and what this might do to the pollution problems in the harbor. Also this summer we have just completed an experimental study of heated water discharge from the proposed Pilgrim nuclear power plant of the Boston Edison Company on Cape Cod Bay just south of Plymouth. Here we have gone upon previous FWPCA basic research dealing with the control by the proper engineering design of heat and water outlets. We know how to produce the effect of scaling the water on the surface, deposit it in a thin layer where you can produce a high degree of heat dissipation to the atmosphere. We know how to mix it, produce relatively lower temperatures involving more of the water. These techniques are available from an engineering design standpoint and, as other speakers have mentioned, it's up to the biologist to indicate in certain areas which are the most desirable means to minimize the effects. The previous speaker mentioned aquaculture. One of my graduate students is also looking into the utilization of thermal effluents from the Millstone plant in

Connecticut for increasing the yield of scallops, this in connection with a group at Woods Hole who are interested in this subject also.

A number of years ago we assisted in the design of the new Mystic River dam, created the Mystic River basin and proposed the new Charles River dam expressly for the purpose of reducing the amount of saline water intrusion into the basin as a result of boats operating through the locks.

I think one of the important existing problems in the Charles River is the present very large locks which are inefficiently used for small boat operations and the fairly large amount of salt water which comes into the bay and forms a stagnant pool at the bottom creating sludge deposits and odors. In conclusion again I would like to express not only our appreciation but our active support of the very effective research program of the Federal Water Pollution Control Administration.

CHAIRMAN KLASHMAN: Thank you very much, Professor Harleman. We'll look forward to getting a prepared statement from you within the next couple of weeks. Are there any questions? I would now like to call on Mr. LaRoque. Mr. La Roque, how long is your statement?

MR. PAUL K. LA ROQUE: Quite brief, sir.

CHAIRMAN KLASHMAN: What is it, about five minutes? Is it one page? Thank you. Do you have a copy of that for us?

MR. LA ROQUE: In a book entitled "The Big Water Fight", published by the Stephen Greene Press, and sponsored by the League of Women Voters, is the following statement, "It must never be forgotten that water is a political problem."

Water pollution presents many avenues worthy of deep exploration. However, when one talks about a system of management, or control, he is talking about politics.

My own experience in this area involves an attempt by the New North River Association, a citizens group based in Salem, Massachusetts, to eliminate pollution in the North River, a situation which has grown increasingly worse since the late 19th century.

The River has long been a popular issue for political office seekers in the area. Regrettably, until this year, the winners have not taken positive steps toward providing a cure. Without dwelling on the activities of the New North River Association, it should be stated that a vigorous promotional campaign has taken place during the past eight months, aimed at Government officials. The use of signs, floats, radio messages, newspaper articles, and a petition to Congress bearing some 13,000 signatures, did finally create a stir of meaningful activity.

However, it is often the political activity itself which becomes most difficult for a community with a pollution problem. There is an inability among officials from different political levels to work together towards a common goal.

It is an inability born of natural and understandable jealousies and suspicions which seem to be an inherent part of American political life. City, state, and federal officials tend to go their own way, using their own staffs and agencies, and the results are often expensive duplications of effort which produce a multitude of differing opinions on how a project might be handled.

In the case of Salem's North River, the efforts of our Association have been largely responsible for several recent meetings and exchanges of correspondence among office holders at the various levels. We have even gone so far as to have our own engineering team draw up its own proposal for a temporary solution and we have submitted it to all interested parties.

The sadness lies in the knowledge that it was necessary for private citizens to take such a stand, and that political self-interest could, for almost one hundred years, prevent a sensible and economical solution. If pollution problems are to be solved through political channels, a way must be found to bring our many Government bodies together in a unique unity. It is important for a local official to know how much financial help he might expect from State and Federal Government. It is equally important for State and Federal officials to understand and sympathize with the needs of local officials, for the local official is closest to the wishes of the people in his own community or neighborhood.

Perhaps our political system has become so complicated that concentrated citizen action is the only alternative. However, as the New North River Association continues its efforts to eliminate one of the worst, and oldest, pollution problems in this part of the United States, we hope to discover a practical formula which will serve as a guide for other communities interested in developing and protecting estuarine resources.

In the near future, we believe that we will be able to supply the Federal Water Pollution Control Administration with detailed and pertinent opinions on the management aspect of water pollution. Yours very truly, New North River Association, Paul K. La Roque, Communications Director.

CHAIRMAN KLASHMAN: Thank you very much, Mr. La Roque. Are there any questions? I should now like to call on Gerald F. O'Leary, Boston City Councilman. You are also a member of the General Court, aren't you, Mr. O'Leary?

MR. GERALD F. O'LEARY: Yes. Thank you, Mr. Chairman. Ladies and gentlemen, my remarks will be very brief. I prepared no official remarks. I will submit some suggestions to the committee in writing. I would like to say this. I just want to make you and the people in the audience aware of what avenues in the local and state areas are available and, in particular, in the city area. I filed an order and it has been passed in the city council and the Mayor will appoint a body of members to this committee to work and develop a comprehensive plan for the harbor and the islands with a view toward proper industrial and recreational use of this great asset, in my opinion and the opinion of many, probably the State's greatest natural asset. We need a well-rounded approach to the problem and we are going to solicit all the help that we possibly can from civic and local groups, scientific groups, city groups and state and federal groups so that we can, for once, as a previous speaker mentioned, try to coordinate all our activities along intelligent lines so that we will have a full enjoyment and proper usage of the harbor and also correction cost of any municipal misuses of polluting the harbor and a positive program in that direction. I'll just make that statement so that if anybody here would like to assist or feel that they can bring any information that would be helpful to this committee, I would appreciate it if you would get in touch with me. I would like to say that the committee will work in full cooperation with any group and with you gentlemen here.

CHAIRMAN KLASHMAN: Thank you very much, sir. I would like to make an announcement, Mr. Mario Boschette.......Oh, he's left. He had a telephone call. I would now like to call on Mr. John Lebourveau, New England Electric System. Do you have a prepared statement?

MR. JOHN W. LEBOURVEAU: Yes, and I have given copies to the secretary.

Mr. Chairman, my name is John W. Lebourveau. I am employed by New England Electric System as Environmental Engineer.

New England Electric System is a major electric and gas utility organization serving 250 communities in New England. We have a specific interest in estuarine zones based on the operation of generating stations at Salem, Lynn, and Somerset, Massachusetts. In addition, we own transmission and distribution facilities constructed in coastal areas.

We of the electric utility industry have a more general interest in estuarine zones because we recognize the advantages which these lands and waters offer to our communities. Most of our larger coastal towns in Massachusetts are located on estuaries because of the harbors which are found there. The appeal of the sea has caused the development of fine communities all along the coast. The future offers the prospect of new economic developments based on oceanography, commercial sea farms, and extraction of chemicals from sea water. All of these factors may contribute to the development of our service areas, and hence to the market for electric power.

We have reviewed the legislation which authorized this present study and which specifically defined the major content of the report which will be forthcoming. One of these requirements is a set of "recommendations for a comprehensive national program for the preservation, study, use, and development of estuaries of the Nation, and the respective responsibilities which should be assumed by Federal, State, and local governments and by public and private interests." (Section 5, g, 3, c of the Federal Water Pollution Control Act).

It is our opinion that the problems of estuarine zones cannot be separated from the problems of other lands and waters. As we review federal and state legislation on this subject we are impressed with the extensive body of public policy which has already been defined by legislation and the activities of government agencies.

In 1899 Congress became concerned with debris which was accumulating in harbors. In addition, control was established over dredging, disposal of dredged material, and the filling of harbor areas which might affect shipping. Within the past year or two, the considerations for issue of permits for dredging, etc., have included the effects on fish and wildlife, conservation, pollution, and the general public interest.

National policy very early recognized the unique values of certain seashore areas for historic, recreational, esthetic values and for the preservation of wildlife. Within the National Park Program we find that New England was the site of the first National Park east of the Mississippi River with the establishment of Acadia National Park in 1919. Recently the Cape Cod National Seashore was established in 1961 and includes certain estuarine zones. This legislation goes as far as requiring local zoning ordinances to be approved by the Secretary of Interior to see that they are consistent with the terms of the Act establishing the Seashore. As recently as August of this year the passage of HR25, now Public Law 90-454, has provided for establishment of Estuarine Areas, presumably following the thinking of Seashore Areas and other Park Areas.

The protection of shellfish from pollution, particularly as a result of deposition of dredged material, was established in 1905.

The control over pollution of waters themselves, with the exceptions mentioned above, was largely considered a state responsibility until about twenty years ago. In 1948 the Public Health Service was authorized to provide support and aid to the states, particularly in research. In 1956 the Surgeon General was directed to prepare a program for eliminating or reducing water pollution and to establish enforcement proceedings. This was soon followed by a grant program to encourage the construction of sewage treatment facilities.

In 1966 the Federal Water Pollution Control Administration was established in the Department of Interior. At this time a major effort was begun by the definition of standards by states. These standards are now in process of approval by the Secretary of Interior. This will be followed by remedial measures to control existing pollution and a permit system to limit discharges from new sources in the future.

On the basis of this record, therefore, it is evident that Congress has recognized the problems of pollution, has assigned responsibilities, and has appropriated funds to carry out these programs.

Here in Massachusetts our state legislature has a particularly fine tradition of concern over our estuarine waters and related land areas. It appears that an act was passed in 1788 which protected the migration of anadramous fish into the Mystic River. This act limited the construction of dams and other obstructions to fish passage.

In 1899 we find a court case where a canal company was required to pay damages to oyster fisheries as a result of the improper deposition of dredged material.

Our State Department of Public Health was established in 1869 and was recognized throughout the country as a pioneer in development of sewage treatment facilities. It continues to carry out extensive programs in inspection of shellfish areas, in the monitoring of radioactivity in marine waters as well as inland waters, and the regulation of dumps which frequently pollute both land and water areas of estuaries if not properly managed.

In 1966 the Department of Natural Resources was given general authority over water pollution control in the Commonwealth. Our industry participated in hearings which dealt with the classification of coastal waters. We are following the new procedures which call for permits in connection with generating stations or other facilities discharging to tidal waters.

We are particularly proud of the Wetlands Control legislation which controls the utilizing of marsh areas and is intended to protect the biological and esthetic values therein. This control was established over salt marshes in 1963 and over inland wetlands in 1967.

Time does not permit a complete enumeration of the activities of our state government. We can only mention in passing that local communities have been active in this respect also.

Perhaps the persons in your organization who are charged with writing the final report would find in Massachusetts an example of what a determined people can do to control their environment.

We in the electric utility industry support this concern for the estuaries. We make this statement with full appreciation that additional generating stations will be required and that many of these will be on the seacoast. With proper coordination, with detailed engineering and biological studies to determine how to best fit each facility into its particular environment, a balancing of values will result which will be in the public interest.

In summary, there is already a body of public policy established which can be used to protect and manage estuarine areas. By the granting of permits, by the establishment of standards, the various government agencies can implement the long range planning each is required to perform. Public hearings, such as this, will focus the public interest on specific problems. Numerous coordinating agencies already exist which can promote an interchange of ideas between specialized groups. Public law 90-454 referred to above already requires all federal agencies to consider the value of estuaries. In addition, state and local subdivisions are encouraged to consider estuaries in their application for federal funds.

We believe that coordination and adequate funding of existing programs is the most effective means of protecting and developing our estuarine areas.

MR. PAHREN: Thank you very much, sir. Do you have any questions, Mr. Peloquin?

MR. PELOQUIN: No. questions.

MR. ZABRISKIE: Mr. Chairman, I would like to state for the record that the gentlemen representing the utilities, that the cooperation we have received from them (from the utilities) and associated industries has been commendable as a gentleman so stated because of their activities has brought about the legislation we have on the books and we respectfully request, in fact we insist on their future cooperation.

MR. PAHREN: Thank you, sir. The next speaker will be Mr. Henry Lyman. He is with the Salt Water Sportsman and also associated with the New England Aquarium.

CHAIRMAN KLASHMAN: I understand that you will be speaking for both.

MR. HENRY LYMAN: Yes, Mr. Chairman, I am wearing two hats. I will speak first as Vice-President of the New England Aquarium Corporation, and if I may, rather than presenting the two papers that I have here, I would like to make a brief summary on them.

CHAIRMAN KLASHMAN: Fine, and you will put them in the record.

MR. LYMAN: The copies have already been filed with your assistant.

(Statement by Henry Lyman, Publisher, SALT WATER SPORTSMAN.)

Recreational marine fishing has become a major coastal industry with 8,305,000 anglers spending approximately $799,656,000 in the year 1965, according to the National Survey of Hunting and Fishing. (Resource Publication #27). Of these totals, about 1,530,000 fishermen spent $121,283,000 in the New England and coastal New York areas and captured 316,360,000 pounds of fish by their efforts (Resource Publication #67). If their catches were worth 40 cents a pound in the round, they more than got their bait back!

The rate of growth of this sport fishing activity has been about 7% a year in the past decade. Thus the expenditure in 1968 by sport fishermen in the New England-New York coastal area was roughly $148,500,000. These figures do not include capital outlays by the sportsmen themselves, such as purchase of boats, nor such outlays by those who provide services--hotel and motel owners and the like. Suffice it to say that the value of marine angling is tremendous as far as local coastal economy is concerned. In Massachusetts alone, it is a major contributing factor to the tourism industry, which stands second in importance on the Bay State's industrial list.

All species of sport fish are dependent upon the estuarine environment to some degree for spawning, nursery or feeding grounds. Although the exact values have been argued for years by ecologists and economists, all agree that the water acreage and supporting wetlands of the estuaries provide a substantial amount of the total fishery population and, therefore, of the cash value of that population.

Pollution of these estuaries destroys both aquatic life and subsequent dollar yield. To place a dollar value on aesthetics and on relief from the strains of living in this present high speed world through relaxation by angling is even more difficult than trying to place an exact value on finfish produced by any given estuary. To one hanging on the edge of a nervous breakdown and anticipating a ream of doctor and hospital bills, the value is incalculable.

Pollution in one form or another has destroyed countless acres of estuarine environment in the past decade -- and the destruction continues. The exact acreage can be computed when a section of coastal marsh is drained or filled. It cannot be accurately computed when the pollution has a cumulative effect, as in the case of modern pesticides, nor, at present, when eggs or juvenile specimens of fish are destroyed while adults remain comparatively unharmed.

In point of fact, the definition of pollution is an extremely difficult one to pinpoint. Raw sewage in small quantities flowing into a biologically barren estuary may actually benefit aquatic life. This same pollutant added to an estuary already overburdened with it may destroy aquatic life. Therefore research into the possibilities of beneficial transfer of pollutants from one area to another should be accelerated. This can best be done under leadership of a federal agency.

Whatever uses are to be made of coastal zones in the future, there is no question that recreational uses will increase. Longer life expectancy of our citizens, more leisure time, higher per capita income and a constant seeking of escape from the high pressures of modern life are forcing people towards the sea and its bordering land areas. Unquestionably many estuarine areas will be zoned for a variety of uses just as land areas are zoned today in a well planned community. The estuarine zoning should be done by local communities, which have a day to day contact with the situation prevailing, but basic standards should be set by State and perhaps even Federal Governments.

Increase in recreational boating itself presents a problem with respect to pollution by trash and raw sewage. At present, this problem has been thoroughly confounded by establishment of some State criteria and by proposals of what appears to be more lenient federal criteria. Those working on this problem should communicate more closely to establish workable, economically possible regulations which could be accepted by the boating community. Sound federal leadership through a single agency is required.

The Federal Government should continue to establish basic water quality standards with regard to estuarine river pollution, but such establishment should be expanded to include the estuaries themselves. Conflicting rulings from various agencies have caused confusion simply because there has been poor inter-agency communication. The standards should come from a single federal source and then, if desired, may be made more stringent by State and local action.

Costs for controlling pollution are high and, for the most part, are too great to be borne entirely by individuals, private industries or smaller governmental divisions. Federal relief in the form of direct financial support should be concentrated on basic overall research and method. Other support should come through tax relief, with those cooperating in pollution control receiving the greatest financial reward.

Definite deadlines for establishment of pollution control at the local level should be set by State and Federal Governments. If the polluter fails to act prior to such a deadline, he should be taxed at a rate based upon the gallons per day of the pollutant discharged. Precedent for such action may be found in the sewer use tax imposed by many communities.

Accelerated research in the legal and economic fields should also be conducted by the Federal Government. In many coastal areas, legal responsibilities are vague at best and economic pressures by local polluters overshadow all other values. Model laws and regulations should be provided as guidelines. These guidelines should be flexible so that, when advances are made in techniques of pollution control, they could be modified.

Long-term monitoring programs for detection of pollution in any form and in determining effects of such pollution should be accelerated. Financing should be done at the federal level working in cooperation with the States involved. Long-term approaches should always be kept in mind even though short-term action may be required to clean up a particular problem. Thus an underwater project for the recovery of gold might adversely affect a local fishery temporarily, but, after mining had been completed, the fishery might be improved due to over-turning of ocean floor nutrients.

In brief, the Federal Government, working through a single agency, should take the lead in establishing workable, basic criteria for pollution control; should finance, directly or indirectly, efforts for this control; should reward financially those who cooperate, and penalize those who do not.

******

(Statement by Henry Lyman representing The New England Aquarium.)

Estuaries and lagoons with their marsh or mudflat fillings constitute 80-90 percent of the Atlantic and Gulf of Mexico Coasts and 10-20 percent of the West Coast of the United States. The estuarine habitat is, however, being drastically altered by man so that those portions suitable for wildlife have shrunk by about 7 percent in the last 20 years.

The estuarine environment with its associated salt marshes is of prime recreational and esthetic value; it acts as a buffer zone between sea and land during storms and has potential as marine shore park land.

Since Americans will spend an increasing amount of time in leisure activities as the years go by, it is desirable that the widest possible range of recreational environment be available. In New England this is of particular interest as recreation is our second largest source of income.

Estuaries and salt marshes are among the most productive areas on earth. For example, the net annual production of phytoplankton of Long Island Sound is about 36,000 lb./acre while by contrast good Iowa farm land will produce only about 2,700 lb. shelled hybrid corn per acre per year. In terms of animal production the annual yields of estuaries and good farm land are about equal at roughly 800 lb./acre. However, when aquacultural methods are employed the yield of animal matter from estuaries can be boosted as high as 52,000 to 270,000 lb./acre.

The importance of the estuarine environment in the production of shellfish is well known. However, not as well appreciated by the general public is the necessity of this environment as a nursery ground for many species of commercial and sport fish. A case in point is that of the striped bass. The main nursery ground of this species is Chesapeake Bay; from there the fish migrate North in Summer to the waters off New England. The success of the New England fishery is thus dependent on estuarine conditions in the Middle Atlantic States.

The fact that the prosperity of our marine fisheries is related to the integrity of our salt marshes, long known by biologists, achieved its first legal recognition on March 9, 1964 when Massachusetts Judge Horace T. Cahill ruled that Broad Marsh is a salt marsh necessary to preserve and protect marine fisheries. This historic decision elevated the status of salt marshes above that of wasteland. Since then further progress has been made in the legal battle to save the estuaries and salt marshes in other states.

These legal decisions have, however, been made only at the State and not on the Federal level. Because wildlife in its migrations takes no regard of man-drawn lines on maps, it is essential that the Federal Government or a multistate agency should play a role in the conservation of the estuarine environment in the public interest. Given the present headlong destruction of estuaries as fish habitat, it may well be that the great estuarine habitat to the South, upon which New England fisheries depend, may disappear in the absence of Federal or multistate control.

The precedent for this control has already been set in the management of rivers that flow through or are bordered by more than one state in their path to the sea. The effective management of marine resources, of which pollution control is but a part, would seem to require an integrated approach by all agencies whose activities impinge on the marine environment up and down the coast.

The necessity of the estuary in the life cycles of many marine animals is well understood; also well understood are many of the grosser effects of pollution. For example, the overloading of an estuary with excessive quantities of wastes high in suspended solids and BOD will predictably cause a nuisance and disastrous results to fish and invertebrate populations. However, some wastes, particularly sewage, are also a source of nutrients and their carefully controlled release into the estuarine environment could lead to beneficial results in the form of enhanced productivity. So called thermal pollution, where the temperature of the environment is raised by the dumping of cooling water, may also have beneficial results, in particular by raising growth rates of organisms in Winter when growth often slows to a standstill. It would seem that the controlled release of sewage and thermal effluents might have value as aquacultural methods as has already been shown in one or two isolated cases.

New compounds are constantly being produced by the chemical industry. Many of these eventually find their way into the natural environment where they may or may not be readily broken down. A group of compounds in the latter class are the chlorinated hydrocarbons, many of which are extensively used as insecticides. One such substance is DDT; this compound tends to concentrate in the fats of organisms and, as it passes along food chains, builds up to ever increasing levels in the tissues of animals of the higher trophic levels, even to the extent of causing breeding failure or outright mortality. No one knows the ultimate effects of these types of chemical pollutants.

Pollution may take other forms--dredging operations in which bottom sediments are disturbed result in the production of huge clouds of suspended matter, which must eventually settle and in doing so may destroy valuable oyster beds or other important habitat. -- Oil well drilling operations may release crude oil or concentrated brines to the environment with possible harmful effects. Concentrated brines may also pose a pollution problem when desalination becomes widespread. Estuarine pollution should be defined to include all nuisance-producing activities of man in the estuarine environment. It is proposed that pollution and its control, in the broadest sense of these terms, be placed under constant investigation and that the many Universities and other concerned Institutions in the New England area be stimulated and encouraged to develop appropriate research programs.

The New England States have led the country with their programs of estuarine and salt marsh conservation. These states have matchless educational institutions and research and development industries. New England should be a model for the rest of the country in water pollution control and provide the nexus of investment opportunity in pollution based industry.

The New England Aquarium recommends that:

1. The estuarine environment be conserved with a view

to its importance to fisheries, recreational opportunities and potential uses in aquaculture.

2. Because pollutional events taking place in an estuary may affect fisheries and recreation hundreds of miles distant and several states removed, arrangements must be made to have an immediate exchange of information and greater communication between the appropriate agencies along the coast.
3. The Federal Government should support the investigation of aquacultural methods in pollution control, in an effort to harness the nutrients in wastes and make them productive.
4. The Federal Government should establish uniform standards for the conservation of water resources. It must encourage the individual states to participate in this so that realistic quality standards can be set. Unless the states are completely involved, they will not be able to obtain the economic support of their individual communities and will be unable to establish long-range plans and effective solutions.
5. The Federal Government should give all possible encouragement and aid to those State Governments that are progressive in water pollution control. The less progressive State Governments should be

assisted in developing education programs in order to generate the public concern necessary for political action.

6. The Federal Government should place a much higher priority on Research and Education in pollution control by stimulating and supporting programs in the many Universities and other appropriate Institutions of the Nation. The ever changing problems in pollution and its control would thus be brought under constant investigation and reclarification.
7. The Federal Commission on Water Pollution should request that the National Research Council--National Academy of Sciences conduct a national conference on the subject of estuarine pollution and the Commission should provide funds for this purpose. The study should consider all aspects of the problem including social, economic, political, managerial, as well as the technological and scientific.

CHAIRMAN KLASHMAN: Thank you very much, Mr. Lyman. Are there any questions?

MR. PELOQUIN: Sir, could you expand a bit or explain why you feel the New York boat pollution laws are not enforceable or impossible to enforce.

MR. LYMAN: Let me say this. The boating industry as a whole considers that they are not enforceable because of the financial burden put not only on the boating industry but upon the boat owner, the individual boat owner. However, I probably should have clarified this more clearly. The main reason, I believe, that they will not be enforced is that within a matter of weeks, the Federal Government is going to come out with recommended laws which will supersede the New York laws and which, as nearly as I can determine and as nearly as legal advisers who have spoken to me can determine, will completely emasculate the New York laws.

MR. PELOQUIN: Is this the section or the laws contained in the proposed bill Senate 3206?

MR. LYMAN: Yes.

MR. PELOQUIN: It seems to me that this law pertains only to coastal waters and does not apply to inland waters. Of course, we are concerned with coastal waters here.

MR. LYMAN: Did you say "will not apply to coastal waters?"

MR. PELOQUIN: Will apply to coastal waters and not inland waters and possibly, I don't know just how far, in the estuary. Of course, this is an area we will have to watch when the legislation is pending, I agree on that point, yes. Thank you, sir.

CHAIRMAN KLASHMAN: Are there any other questions? If not, thank you very much, Mr. Lyman. I am now going to call on Dr. Charles F. Cole, University of Massachusetts. I believe that by the time Dr. Cole gets finished it will be about 12:30. We will adjourn then for lunch. We have about ten more people who have asked to talk. I'm hoping that we will get out of here by .....if we reconvene at 1:30....we may get finished before 3:30. If anybody has a statement that is only for two or three minutes, would you please indicate to the secretary. We will try to put you on first, if you have a very brief statement. Thank you. Dr. Cole.

DR. COLE: The University of Massachusetts and the Massachusetts Cooperative Fishery Unit in cooperation with the Federal Water Pollution Control Administration and the Massachusetts Water Resources Research Center have been concerned with estuarine fisheries resources since the inception of a graduate program in fishery biology at the University in 1964. We have particularly devoted our efforts to providing a long-term view of the ecology of the fishes of a small estuary in upper Buzzards Bay, the Weweantic River. The Weweantic River enters Buzzards Bay after arising in Carver, Massachusetts. It flows through flat agricultural lands devoted primarily to cranberry growing (approximately 4,000 acres are now under intensive cultivation) and then passes between the towns of Marion and Wareham, two towns which place high recreation values on the marine environment. Several of our studies are completed and should provide us in Massachusetts with a new and detailed look at the ecology of fishes in one of our estuaries and the factors that control their numbers.

Our first study in 1964-65 considered certain aspects of the winter or blackback flounder, probably the most frequently caught fish in Massachusetts estuaries and the only flounder in our commercial catch that is tied biologically to the estuary for its existence. Other studies elsewhere in southern New England have demonstrated that localized populations of winter flounder return from off-shore to spawn in estuaries and the Weweantic is no exception. The developing eggs, larvae and juveniles remain in the estuaries and normally do not leave estuarine influence until after the third year. However, as we traced the returning adult flounders in fall 1964 through 1965 and then monitored their spawning success we were disappointed to find nearly twice the mortality in newly hatched larval flounder as that which had earlier been documented in an eastern Connecticut estuary (the Mystic River). Such increased natal mortality may have been related to many adverse natural conditions that frequently plague year-class success in fishes. However, the extensive agricultural and mosquito control management with pesticides in the Weweantic watershed alerted us to a possible second alternative suggestion; namely, that either a chronic or an acute poisoning by pesticides could have caused larval fish mortality. A particularly interesting mortality occurs when fish accidentally ingest pesticides along with their food and then store this toxic substance in their fatty tissue reserves to get it out of the active flow of food. Unfortunately, a convenient fat storage site in females is the yolk in the maturing egg. The effects on the developing larva that later uses this food source can easily be surmised. Instances of this sort have been documented in lake trout in New York and more recently in salmon in Michigan among others. Accordingly, we began to monitor ovarian and whole muscle content of returning adult female flounder and also muscle tissue content of the resident juvenile flounders in the Weweantic from July 1966 through June 1967. This study has just been completed and from it we can conclude that the returning adult flounder do increase their content of DDT and Heptachlor (persistent pesticides) as they feed in the Weweantic estuary and that as the ovaries mature, these pesticides and their degradation products are concentrated in the fat-rich developing ovaries. We cannot yet state whether the levels detected are sufficient to cause the increased mortality earlier noted but we will be evaluating this contention in further studies. Incidentally, our study is apparently the first known case of a marine fish accumulating pesticides while in estuaries to which they have returned to spawn. Our information on current pesticide use in the watershed indicates that not only has the cranberry industry moved away from a heavy use of the more persistent pesticides in much of their current management applications but that significant amounts of the persistent organochlorine pesticides are now or have in the past been applied to control mosquitoes. However, the long-term persistence of these organochlorine pesticide residues in the muds of the estuarine bottom will doubtless affect fish in the Weweantic estuary for many years to come even should persistent pesticides be banned from Massachusetts tomorrow. Parenthetically such state-wide bans of persistent pesticides have already been applied in some of the states bordering the Great Lakes. I would emphasize that though I personally urge such action in this state from general principles, we are yet not in possession of data which would conclusively prove that winter flounder populations in this estuary or any other in this state have been or are now being markedly reduced or otherwise damaged by pesticides. We know only that pesticide residues are there, that they become concentrated in fish tissue after the fishes return to the estuary, that they are further concentrated in the ovaries and thus also apparently into the eggs, and finally that the young flounder living year round in the estuary until their third year of growth have higher body concentrations than do the spawning adults that move in and out of the estuary. Our next step is to determine how much pesticide is deleterious to the fish, how widespread this problem of estuary residue is in the state and to assess its effect on the fishery resource now and in the future.

Human modifications of estuaries can be more gross than that caused by pesticides. The two towns (Marion and Wareham) in our study area are joined by Massachusetts Highway 6 which passes over the river on a dike or causeway which is breached only in two places and these breaches are spanned by two small bridges. As would be expected, these passes, concentrating tidal action and stream runoff, have caused the bottom to be scoured into two channels that extend above and below the bridge for as much as 500 yards. Between these channels above and below the bridge are two very shallow mud flats which apparently have been created since the construction of this bridge about 15 years ago. Though the bottom profile in this river has obviously been changed, one also should consider the bridge's effect on the salinity patterns, the ebb and flow of tides and thus the distribution and survival of young fishes spawned in this estuary such as American smelt larvae and winter flounder young. This change in our study area took place before our work began and we can now only speculate on the effects of this type of bridge construction on the ecology of the river. Highway construction practices can obviously adversely affect estuarine fisheries resources.

Another study being conducted on the estuary has sampled fish eggs, larval fishes just after hatching and the juveniles produced in or carried into the estuary over a period of three years. A total of nearly 60 species of fish are now known to use the estuary for some phase of their life cycle. The winter flounder, tomcod, American smelt, tautog and cunner are among the dominant sporting species in numbers and thus in importance to the system but such species as bluefish and striped bass are also seasonally important. Many of these species are currently under investigation by students studying for the master's degree at the University. Such species are part of the diversity that entrances the saltwater angler and attracts him and his family to the shore. Studies of the economic impact of the marine sportsman in Massachusetts and the total fishing pressure placed on the resources by sport fishermen in upper Buzzards Bay are also subjects for master's theses. We must know in economic terms the scope of resource utilization before estuaries can even be discussed intelligently in terms of dollar value and counter-use proposals. We realize the esthetic components of the total resource cannot be given value meaning but feel that considerable segments of the resource can and should be given such interpretations.

Other researchers at the University have been involved in such diverse problems as the sedimentary patterns in the Newburyport-Plum Island complex, and the biology of the mud flats in Barnstable harbor. Though the Massachusetts coast has been investigated by a varied group of geologists, zoologists, ecologists, and fisheries workers for many years, there are still many untouched problems many of which lie in the area of understanding grossly disturbed estuaries. We expect that the University of Massachusetts will continue to play an important role in assisting the state in evaluating its estuarine resources and in assisting regulating agencies in directing these resources to the best possible long-term use.

CHAIRMAN KLASHMAN: Thank you very much, Dr. Cole. Are there any questions? If not, we can adjourn until 1:30. We will reconvene then.

(The meeting was then adjourned until 1:30 P.M.)

CHAIRMAN KLASHMAN: I would like to first call on Mr. Melbourne Carriker, Marine Biology Laboratory, Woods Hole. Mr. Carriker, do you have a prepared statement? Can you give us a copy?

MR. CARRIKER: I have already given one to the secretary outside. Let me introduce myself. I'm from the Marine Biological Laboratory in Woods Hole, Director of the Systematics Ecology Program there. And our concern is the study of the fauna and flora of the Cape Cod region. I felt compelled to say something by way of identification of basic biological problems in need of further study in relationship to the subject under discussion.

At the current rate of growth of the human population and the parallel rate of degradation of estuarine and coastal areas, it is evident that it may not be possible at least within our lifetime to return the quality of the water in these zones to its primeval purity. We are left to work, then, in a compromise somewhere between those levels of the residues of civilization which organisms can tolerate, and those within which they may be fit for human utilization.

Before we can establish a realistic standard against which to improve the quality of our coastal waters for the purpose of enhancing the production of fin fish, shellfish and other biological resources, however, we will have to know much more precisely under "normal environmental conditions" the total potential kinds of useful species, their breeding conditions, their life histories, their food requirements, their environmental and physiological needs, their tolerances to environmental extremes, their capacities to migrate and to adapt to changing conditions. This information is likewise necessary for management and conservation of these resources. Unfortunately, because of the rapid encroachment of man upon our coastal areas, there are not many reaches left where "normal" conditions prevail. This situation lends a note of urgency to the amplification of such studies before all of our coastlines become afflicted by man's wastes and alterations.

By way of example, let me identify briefly a few of the studies which

I would like to suggest are basic to actions needed to assure wise use of our coastal biological resources:

(1) Most microscopic, as well as many macroscopic organisms along the Massachusetts coast are still relatively unknown, and the early life histories of these organisms are even more obscure. This hiatus points to the necessity for investigations, based on laboratory culture, of identification of life history stages and morphological changes in development. These studies are important because we must learn the total array of organisms associated with commercial and potentially commercial species, whether as food organisms, competitors or predators. Furthermore, there is a serious lack of publications for the identification and classification of coastal organisms. It goes without saying, that in all branches of inquiry it is necessary to facilitate identification of the basic units of information.

(2) Quantitative analyses of variations within natural populations of organisms at specific and subspecific levels are fundamental not only for determining the taxonomic limits of these taxa under normal environmental conditions, but also to establish standards for evaluating the effects on these organisms of thermal, chemical and sedimentary wastes. A basic consideration in studies of morphological, physiological and behavioral variation is not only the degree of genetic constancy that prevails, but the possible spectrum of variation induced by ecologic factors. This concept calls for a range of experimental studies on the influence of normal environmental factors on taxonomic characters and the possible formation of ecological variants.

(3) Coastal populations possess characteristic ranges of tolerances to natural factors of stress, not only in their respective habitats, but

also to the ionic, thermal and sedimentary factors transported in land drainage to them. Little is known of the physiological adaptation of organisms to these, or of the variation in tolerance limits of biota in the stable open coastal waters as compared to the unstable estuarine habitats. Obviously, such information is fundamental to an assessment of the tolerances and adaptations of coastal organisms to residues introduced by man.

(4) How populations originate, become established and are controlled ecologically is one of the important questions in ecology, and of paramount significance to pollution studies. Yet little research is being done in this area. Studies by means of laboratory culture of the autecology and behavior of early life history stages with reference to movement of crawl-away juveniles and settling of planktonic larvae in relation to the community of associated organisms are suggested.

(5) Information on time of year and duration of breeding periods and reproductive rates in relation to the annual climatological cycle and to productivity under normal environmental conditions should be available as a base of reference for pollution studies. There is a paucity of information on this subject.

The optimum economic biological value of estuaries and coastal zones can be realized only through a full understanding of the scope and depth of the complexities of the estuarine-coastal environment and the organisms dwelling there. This understanding is likewise necessary in the wisest resolution of the conflicting uses of these areas. There are thus at least these two important reasons for greater support by the Federal Government of research and training in the basic biological problems of the rim of the sea. The State of Massachusetts is noted all over the world for the quality of its marine biological laboratories; it is consequently a favorable region of coastal United States for expansion of the basic studies recommended in this statement.

CHAIRMAN KLASHMAN: Thank you. Are there any questions?

DR. CONOVER: Mr. Carriker.....

CHAIRMAN KLASHMAN: Excuse me. Would you identify yourself, please.

DR. CONOVER: Yes, sir. I'm Dr. John P. Conover. Am I out of order, sir?

CHAIRMAN KLASHMAN: Yes. May I explain what our problem is? We are attempting to gather for the Congress information that they can use. We have found that if we open this up to a debate, we can be here for two or three days, and we simply can't handle it. I would like very much to hear your remarks later, sir. Are you on the program? You can include your remarks at that time. Thank you very much, sir.

I would now like to call on Frank Backoff, Chairman of the Marine Fisheries Advisory Committee and a member of the Izaak Walton League.

MR. BACKOFF: I have some recommendations we would like to make. Listening to most of the speakers this morning, I have come to the conclusion that much study has been put into this problem of estuaries. I happen to be part of the group in Massachusetts of lay people who started the program for the estuarine studies back in the early '60's. Shown from examples, we found that the Merrimack River in our first study that in 1964 the soft-shelled clam industry harvested $14,000 per annum in income. Yet if the pollution could be reduced in the Merrimack River, our biologists have shown we could harvest a $300,000 industry annually in the Merrimack. At the same time we made a study of the North River in Plymouth County, this river.....

CHAIRMAN KLASHMAN: Excuse me. What was that figure again?

MR. BACKOFF: $300,000 was recommended for water pollution in our program in the North River in Plymouth County (this is not the North River the fellow spoke about this morning of Salem) we made a study of this. This was found that a relatively clean estuary yet at the same time it was found that an industry could be curtailed there.

The Advisory Commission suggested that the Department of Natural Resources study the estuarine program of Massachusetts be sold on the economic value which in our eleventh and twelfth study will show. Listening again to many of the speakers this morning, I was wondering if half of the money now used for study was put into solving the pollution problem, we wouldn't need half the study. We would like to make the following recommendations:

1. States be required to come up with a program within a limited time, say two years, to protect our estuaries or the Federal Government shall force them to.

2. A tax rebate be offered to industry and others as an incentive to clean up pollution problems in these rivers. It is well known that it will take over $2,000,000 to solve the Merrimack River Pollution problems.

3. The Federal Government require all state and local colleges to act as a clearing house for all this information. I again being a lay member of the League Committee studied the black back flounder problem to death in this State for the last seven to ten years. This problem of gathering all this information, I think will be very helpful to the Congress of the United States to come up with some type of program. Many of the states, for example, just last Sunday in Tampa, Florida, the Tampa Times gave a complete article on estuaries. One of the statements was when estuaries shrink, they become polluted and disappear; the life cycle is interrupted, commer-

cial fishing dies off, but more important, so does the human enterprise built upon it. So in the last five weeks I have toured many of the coastal states representing an organization I belong to on estuaries, and I find that from Florida up people are doing something about this. I think this is a good recommendation for Congress to gather all this information within a limited time, and come out with strong Federal protection towards estuaries if the states do not want to do it.

CHAIRMAN KLASHMAN: Thank you very much, Mr. Backoff. Are there any questions?

MR. PAHREN: I would like to ask a clarifying question. You mentioned this $300,000 figure for Merrimack estuary. Isn't this the digger value and not the gross Regional product?

MR. BACKOFF: The digger value in the Merrimack.

MR. PAHREN: Digger. So the actual gross regional value would be about four times this value, in other words over $1 million.

MR. BACKOFF: I use the North River as a clean estuary and our biologists there discovered what they call a blue mussel. They created within a matter of months a $20,000 industry, (This blue mussel chowder is being shipped to New York) by protecting them. The North River in Plymouth County is a clean estuary, so to speak, compared to the Merrimack and others. And yet our studies show that this potential is limited. If a million dollars were spent on the Merrimack, if this area could be cleaned up, we could possibly realize a $2 or $3 million recreation business for the Merrimack.

MR. PAHREN: O.K., do you agree with the $25,000 per acre figure Senator Di Carlo spoke of this morning?

MR. BACKOFF: I think that was a little high.

MR. PAHREN: What would be the.....

MR. BACKOFF: I am not a biologist. I am just on this committee advising them what programs normally you can expect our biologists to answer.

CHAIRMAN KLASHMAN: Thank you very much, sir. Mrs. James Clancy, Weymouth Neighborhood Residents. Mrs. Clancy, do you have a prepared statement?

MRS. CLANCY: No I don't. Mrs. Sherman Smith will talk.

MRS. SMITH: I would like to thank you for giving us the opportunity to speak for myself and for Weymouth. The area which we are concerned about in Weymouth is an area called Mill Cove on Fore River. It is a small cove about as much as 200 yards wide, on which the opposite shore they are building a marina. The fill from this marina is not clean sanitary landfill. This is causing pollution in our water that we use to swim, to fish, to water ski; and we have informed this group under the Jones Act and we have informed the Natural Resources of it. The Town has. This fill is not clean sanitary fill. However, when they go down to look at it, it does look clean and sanitary. We feel that it may cause unnecessary additional pollution of this small area because of spillage of oil, gas and other additional matter from the boats which will also be used in the area. And from a conservation point of view, this is just a little cove used for hundreds of years for waterfowl feeding grounds and refuge. Two winters ago we had a huge swan take refuge in this small area. It has an abundance of clams, for a limited purpose, bait shrimp, plankton and other marine life including several fishes, and we feel that every effort should be made to preserve this cove from water pollution. Thank you.

CHAIRMAN KLASHMAN: Thank you. Do you have any questions? Thank you very much. I would like to call on Mr. Roger Marshall of the Sierra Club.

MR. MARSHALL: I am Roger Marshall of 33 Linnaean Street, Cambridge, Mass.

I am here as Chairman of the Eastern New England Group of the Sierra Club's Atlantic Chapter. The Sierra Club is a National Conservation Organization with a membership of over 60,000 members, and it is dedicated to helping "people explore, enjoy and protect parks, wilderness, waters, forests and wildlife". Nearly 500 of the Sierra Club's members live in the Commonwealth of Massachusetts, whose estuarine areas are the subject of today's meeting.

The Ocean is essentially the only remaining frontier left on the Earth today. As we focus ourselves upon the great challenges it has to offer--whether spiritual or tangible--we cannot avoid contact with and influence upon the estuarine areas which are the buffer zone between our highly developed land and the great undeveloped resources of the next generation.

Estuarine areas, until recently, have received little respect for their importance to marine ecology and their role in the life cycles of marine and aquatic life. Historically these areas have, all too often, been filled-in or dredged-out, polluted with the solid and liquid wastes of our developing society, and then cast off and forgotten when they have lost their aesthetic qualities.

While our densely developed urban areas are rapidly swallowing up most of the remaining open spaces, we are finally becoming acutely aware of the ever pressing need for improving the quality of our environment. The prevention and abatement of air and water pollution, and the development of the recreational potential of our estuarine areas, within strict guidelines for their biological protection, are well conceived goals which must be met to save ourselves from extinction.

The inventory of estuarine areas in Massachusetts include the Cape Cod

National Seashore, two National Wildlife Refuges, many miles of State and privately owned beaches, marshes, parks, sanctuaries and protected areas. It also includes many miles of rivers and coastline which stink from raw sewage and industrial waste as well as acres of shellfish beds whose production is unfit for human consumption.

Massachusetts is very fortunate to have its Coastal Wetlands Act, but it also needs Federal aid in implementation as well as for setting minimum goals which can protect the public so that adequate protection of social values as well as fish and wildlife resources can be attained.

In formulating guidelines for overcoming industrial and domestic pollution of our estuarine areas, much effort needs to be expended in developing guarantees that pollution does not result from the development of new economic and industrial concepts. Three iminently critical examples immediately come to mind:

1. Exploration for oil and gas in the George's Bank area can leave the Massachusetts coast vulnerable at any time to another Torrey Canyon type disaster. There must be adequate protection of estuarine areas from possible contamination from petroleum products during prospecting, mining, and transportation processes, prior to any leases being issued;

2. The proposed Plymouth Atomic Power Plant, as well as fossil power sources using estuarine water for cooling, poses a critical problem of thermal pollution. The necessary studies of thermal loads on estuarine areas must be made and adequate safeguarding standards must be established prior to licensing or permitting changes in thermal characteristics of estuarine areas, by public or private industry;

3. The rapid growth of our megalopolitan environment has created a

critical balance in our water supply cycle. It is evident that before long it will be necessary to commercially develop processes for the desalinization of seawater. Prior to such development it is critically necessary to develop safeguards to protect the estuarine and ocean areas from chemical pollution due to such industrial processes.

In conclusion, it is evident that the National Estuarine Pollution Study should recognize the present critical state of our estuaraine areas, and formulate a National policy with adequate regulation to protect the estuarine areas from being devastated by man. These areas have great aesthetic and psychological value to man in his complex environment, and in addition, man is dependent upon the food supply derived from the fish and wildlife resources which depend upon the estuarine areas for their regeneration cycle.

We trust that the National Estuarine Pollution Study will be successful in establishing guidelines for reaching these goals.

CHAIRMAN KLASHMAN: Thank you very much, sir. Are there any questions?

MR. ZABRISKIE: Mr. Chairman, I would like to say for the benefit of people here assembled that yesterday Frank Griss, from the Division of Marine Fisheries traveled to Washington, D. C. and visited with the Department of the Interior on mineral resources and our resources off the coast, in particular, offshore oil and gas. We are quite aware of the problem. Controls is the factor that we are working on. The other thing is that his Excellency, the Governor, has designated Commissioner Robert L. Yasi as his designee to work with the Federal government on the public land law review commission which has to do with the lands held in public domain, which is quite a giant in itself. We are much concerned with this problem too.

CHAIRMAN KLASHMAN: Thank you. Mr. Warren Blandin, Massachusetts Division of Fisheries and Game. Do you have a prepared statement, Mr. Blandin? Will we be able to get a copy?

MR. BLANDIN: Yes, I have already turned in a copy.

CHAIRMAN KLASHMAN: Oh, you have already given one? Thank you.

MR. BLANDIN: The coastal and estuarine waters of Massachusetts provide irreplaceable wildlife habitat of particular value to furbearers, songbirds, shorebirds and waterfowl. Migratory bird flights occur on our coastal areas at least eight months of the year. Coastal waterfowl habitat and the adjacent shoal and estuarine areas provide wintering grounds for more than 150,000 ducks and about 10,000 geese annually. The economic expenditure by sportsmen to harvest waterfowl has been estimated to be $9 per bird brought to bag. In terms of coastal gunning, this would place a dollar value of coastal waterfowl harvested at approximately $50,000 annually. Aesthetic values of waterfowl and shorebirds are difficult to measure, but wildfowl are a continuing source of interest and study to amateur and professional ornithologists alike, as well as objects of beauty to the casual observer.

A primary factor responsible for the attractiveness of our coastal and estuarine areas to waterfowl is the abundant food supply in the form of food producing plants, and clams, mussels, snails and other marine invertebrates. The destruction of these forms of life by dredging, siltation, pollution by industrial or sanitary wastes and pesticides would greatly reduce the carrying capacity of our coastal waters for waterfowl, thus reducing the abundance of this valuable natural resource.

It is in the best interest of the public that all resources occurring in estuarine areas be protected from activities that tend to reduce further the welfare of these irreplaceable resources. Strict control of any and all activities or processes that alter the natural environment is mandatory. Only those operations essential to the general welfare of society should be permitted, and then under strict supervision, with adequate safeguards to protect our estuarine areas from destruction and/or pollution.

CHAIRMAN KLASHMAN: Thank you very much, sir. Are there any questions? I would now like to call on Mr. Alfred Conrod, Massachusetts Institute of Technology. Do you have a copy of your statement?

MR. CONROD: I do not, sir. I'll have one in a day or so.

CHAIRMAN KLASHMAN: Thank you very much. Would you mind telling us what your position would be at MIT?

MR. CONROD: Oh, I beg your pardon. I am on the research staff, staff member of the Experimental Astronomy Laboratory. Don't ask us what we are doing on oceanography up there.

(Laughter.)

We're one of a number of research organizations doing work on collecting information on earth resources under a NASA program.

(At this point Mr. Conrod illustrates slides.)

CHAIRMAN KLASHMAN: Thank you very much, Mr. Conrod. Do I understand that you will submit to us a prepared statement?

MR. CONROD: Yes, I will. We have a series of reports to be submitted to the Government.

CHAIRMAN KLASHMAN: Fine. May I just summarize what you've said so that I can make sure I understand. What you have said fundamentally is that NASA working with the Department of the Interior, the Department of Agriculture and the Navy Department is developing methods of photogrammetry which can hopefully distinguish between various biota and also may be used in tracing pollution. Is this correct?

MR. CONROD: Yes, that is correct.

CHAIRMAN KLASHMAN: Fine. Thank you very much. I would now like to call on Miss Stella Trafford, League of Women Voters.

MISS TRAFFORD: I'll be very brief, indeed. The Beacon Hill Chapter, Water Resources Committee, League of Women Voters, has been studying Boston Harbor in the past year. We have now realized the magnitude of our undertaking. We still regard our past work as a survey only. From there on we plan to pursue each facet of the subject in greater depth, keeping abreast of the developments in the many agencies concerned. By February 1969, we will present some of our findings to the League as a whole. It is possible that concensus will be reached on certain points at that time. For the present, we can say that most plans under consideration are dependent for success on a permanent solution to pollution problems. There are three major river estuaries in Boston Harbor. Almost any conclusion we might draw about current plans in the Harbor are contingent on those rivers being cleaned up.

CHAIRMAN KLASHMAN: Thank you. I would like to call on Dr. John Conover. Do you have a prepared statement?

DR. CONOVER: I can provide you with one, sir.

CHAIRMAN KLASHMAN: Thank you.

DR. CONOVER: I am a biological oceanographer and was previously working, and am now, as a consultant and educator at large. The reason I wanted to talk to you people and having the privilege of doing so was because -

first of all I've been doing research with funds from the Federal Water Pollution Control Administration grant supporting agency since their inception. And the work is taking me, (also the students that have been working under me), into the very heart of the problem which was brought up this morning by Dean Bumpus and later Professor Moore, also from his delivery in which one considers the word pollution and tries to consider that there might be one specific way of defining the word pollution. It was brought up that apparently there are various ways of looking at it - all pollution is not bad. Apparently there are levels of pollution, whether it is chemical, thermal, whatever it may be, which has beneficial effects upon man, upon wildlife, upon marine life, whether it be terrestrial or marine, fresh water, whatever it may be. And there are those of us who are very concerned with seeing research move in the direction of providing, you might say, a channelling of the pollutants that man or by the efforts of man are being thrown upon the environments in which we live to provide not a damaging effect but an optimal effect, or one which is beneficial to the communities in our environment. The point of fact is that some 80 to 100 years ago, Alexander Agissy's description, for instance, of the marine animals in Boston Bay indicated that there are more abundant forms of fauna and flora which are no longer there today. There are species of fish which were caught there in great abundance back up into the estuaries, for instance, the Merrimack. If you look up statistics in fisheries now, you'll see that some of the species are of commercial importance but where do you find them? Ocean Perch, Whiting, Mackerel, etc., these are now found at greater distances from the shore, as if perhaps the areas of optimum production producing the phytoplankton, the zooplankton, the whole food chain, have moved outward, away from our coastal areas as our pollution gradients move outward. This is something given a great deal of consideration to and there is very little that's been concluded in terms of our biological knowledge.

My own work and that of my students has been in the direction of defining pollution gradients in terms of coliforms, for instance, in coastal waters. These gradients in turn are being related also to hydrological gradients such as the salinity and temperature profiles of the coastal areas especially where there are rivers or runoff problems, or runoff waters, and where there are not. These in turn, interestingly enough, relate to the distribution of bottom plants along these gradients, as related to a number of variables and we will find areas where the bottom plants grow optimally. This type of research needs, in my mind, in that of many of us, to be pushed and pressed. We have these pollutants, we have these various exogenous metabolites and other materials which we must be rid of from our centers of population, coastal towns and so forth, and it is a matter that we are going to be living with this from now on. We should find ways of channeling this to good instead of merely ruining our coastal areas of environment by present practices. Now, I would like to be a little more specific in the last few minutes in what I have to say in the area of a particular situation which comes down to the problem of an immediate solution. It is in fact, a problem where a town, Sandwich, Mass. to be specific, situated on a marshland, is in the throes of fighting off the prospect of having its marshland, a beautiful historic town on a marshland which is rather limited in size, but the point is that that historic town depends on this marshland in many ways for its beauty and is a wonderful place for the people to live and go out, and they are about to scrap this situation because a sewage plant is proposed to be situated on one of the uplands and to use the marsh as a leaching area for this particular sewage plant. Well I'm very very much concerned about this type of problem as one of many. There is already one at Scituate, Mass., for instance. In fact, we stopped and took a look at that on the way up here. For the time it's been in operation, we are very much concerned and many other biologists are very much alarmed about the use of marshes for effluent disposal.

Now, what is the problem at Sandwich? Well, you see you have estuaries where there is a river flow. That is one type of estuary. We've seen examples up at the North Shore where these have become highly polluted. In spite of the fact that there is an effluent of the river waters out of those areas, which presumably is to flush this effluent water from sewage systems and carry them out to sea. Sandwich, however, has very little fresh water flowing into it, and it is sort of a stagnant basin, as it were, the ocean tidal waters move in and then drain out completely. This is a situation where if you put such a system in it means that on every flooding tide the water from the effluent can (which are, of course, of lower density than fresher waters) will more or less be on the surface and spread out through half the estuary and on the ebbing tide move outward. But it would seiche back and forth. And some of us, being very much concerned about this, have tried to consider what could happen in the estuaries such as that. For instance, these effluents are known to have high concentrations of phosphorous, nitrogen, phosphates, nitrates and nitrite nitrogens which, of course, are basic metal nutrients for plant growth. This in turn, will lead to over-production and in turn this develops high BOD, high concentrations of organic matter which in turn can lead to very considerable noxious odors, hydrogen sulfide, the sort of thing that would completely render the living abode or the recreational facility of such a marshland into a rather impoverished and miserable situation. There is something we are even more concerned with and this in my final remarks I would like to comment on. As we talk about tertiary treatment as one of the best final processes for sewage treatment and that the effluent from this is said to be almost pure enough to drink, (well, it isn't) perhaps, falls into the category of water that can be processed for drinking water, but the statistics from, for instance, the California Manual on Water Pollution, from which I quote, "This water had from 500 to 5,000 coli bacteria per 100 ml sample. Basically if you treat sewage, it runs about 10 million or more coliforms per 100 ml and if tertiary treatment plant should run up to 95, maybe 98 or 99% bacteria removed from 10 million you'd come down to only 100,000 coli per 100 ml which, after all, is an index for the possible pathogens present, so that the threat to human health is still a considerable one in an estuarine situation like this. Now think of this in a broad sense. If our margins are employed for the effluents in a sewage plant we still have, in spite of this great reduction, the threat to human health of the few pathogens, (and it only takes one, and you start an epidemic), to consider this as a very unsuitable place to discharge effluents. So what is the final plea? That research should be pushed in the direction of how we can move these pollutants, and how we can define these, (these are substances which are above the normal level) to give us beneficial results. They should be moved to be distributed into coastal waters, perhaps, in such a way that they are going to be beneficial instead of detrimental. Thank you very much.

CHAIRMAN KLASHMAN: Thank you very much, sir, and you will submit a statement? We have two speakers remaining. First, Mr. Benjamin Nason and last, Mrs. Abigail Avery. Is there anybody else here that wants to make a statement that has not been heard? Mrs. Avery? She's gone?

MR. NASON: Thank you, Mr. Chairman. My name is Benjamin Nason. I am Executive Director of the Massachusetts Forest and Park Association. This is intended to be my oral statement; I'll submit in more detail a written statement for the record.

CHAIRMAN KLASHMAN: Thank you very much.

MR. NASON: The control of water pollution has become accepted by the general public, selected officials and governmental agencies as one of the most important challenges facing us today. This is true whether we are talking about the general need to improve our environment and make it more livable, the specific need to provide adequate water supply on the short and long run, the necessity of maintaining and improving habitat for fisheries, to satisfy a growing need for food supply by a growing population or the need to satisfy the increasing demand for recreation. Both Federal and state governments have initiated desirable programs that will control water pollution. It is unfortunate, however, that the Federal funds have not been made fully available. We hope that the Federal government will correct this as soon as conditions permit.

We take pride in the fact that Massachusetts passed far-reaching legislation in 1966 creating a new division of water pollution control and appropriating substantial funds for the water pollution abatement program.

Further, we are satisfied with the water quality standards subsequently adopted for inland and coastal waters. This state-wide program, obviously, will have a direct effect on the control of pollution in the coastal estuaries because much of the pollution added to our rivers and streams is ultimately dumped into the ocean.

In addition, Massachusetts enacted landmark legislation in 1963 to control the dredging and filling of coastal wetlands through a permit system and in 1965, by authorizing the Commissioner of Natural Resources to place such coastal areas under restrictive orders, thereby prohibiting their alteration thereafter. We are concerned that the 1965 law, because of the lack of sufficient funds, is not being implemented fast enough. Although we are hopeful that sufficient funds will be made available soon, at the state level, we suggest that the Federal government through an estuarine protection program, should consider making funds available for this specific purpose to speed up the programs.

As an aside, I think appropriate opportunities are taken by the Department of Natural Resources to use some existing Federal programs, such as the Bureau of Outdoor Recreation, if they are considering the acquisition of wetlands and use BOR funds and make these areas available for recreational purposes. There are other Federal programs, and I am sure the state agencies are all taking advantage of any existing programs. But to my knowledge there is no existing program geared specifically to lend financial assistance in the protection of coastal estuaries for their own peculiar values and this is, I think, something that should be considered by the Federal government in coming up with a coastal estuarine protection program.

To summarize some other coastal concerns without offering here specific recommendations. We are concerned with a problem here, perhaps not a problem, it may be an opportunity, but it has become apparent that there will be some oil exploration off the coast of New England. We do not oppose this, necessarily, but we do believe that safeguards should be adopted to protect estuaries and beaches from the possibility of oil pollution. Pending on the developments that may come, this probably will be a Federal responsibility. We are concerned also with the growing frequency of oil spillage problems and most of the oil spillage seems to come from sources beyond the jurisdiction of our own state.

Another concern which relates to the coastal areas are the increasing numbers of atomic energy plants on the New England coast. We know that more are being considered, and will be considered, because of the fuel source, we recognize that the Federal government has a particularly good opportunity to exercise some control on thermal pollution as regards this development.

Another problem which concerns us, which is of a more local rature, relates to the pollution and development of the Boston Harbor. At least the first three which I mentioned appear to lend themselves more readily to Federal programs. That is, Federal programs of some kind of Federal control or at least an exercise Federal jurisdiction. The fourth is, as I said, primarily a state and local problem, but it's a huge problem and one which probably will be solved only through the expenditure of a considerable amount of money, and we would hope that at least through this method the Federal government may be able to be of assistance, by making available Federal funds as liberally as possible.

This summary of pollution of coastal estuaries will be a growing problem which should be met by a cooperative state and Federal program. We hope that because of national and regional interests in the complexities of state jurisdiction the Federal government will initiate an estuarine protection and pollution control program.

CHAIRMAN KLASHMAN: Thank you very much, Mr. Nason. Do you have any comments? Dr. Oscar Tenenbaum, Regional Director of the Weather Bureau.

DR. TENENBAUM: I am Oscar Tenenbaum, meteorologist in charge of the U. S. Weather Bureau at Boston. I am only here to offer a point of information. As part of the Weather Bureau, I am also part of the Environmental Science Services Administration which is part of the Department of Commerce. And the Department of Commerce has two organizations which are particularly interested in the proceedings here today. One, of course, is the Weather Bureau and the other is the Coast and Geodetic Survey. The Coast and Geodetic Survey is presently carrying out its experimental prediction program of flushing rates in the Penobscot River from Bangor seaward into the mouth of the estuary. In other words, we are attempting to do something about forecasting estuarine rates. This is about as far as we can go now. I can say that my prime purpose of being here today is to indicate to you that we are very much interested in your proceedings and presume that if legislation is passed that we will be involved in the program.

CHAIRMAN KLASHMAN: Thank you very much, Dr. Tenenbaum. Is there anyone here who wants to be heard who has not.....Could you please identify yourself?

MR. LORING: Yes, sir. My name is Richard Loring. I represent the Cultured Clam Corporation and the Aquacultural Research Corporation, both located in Dennis on the Cape.

CHAIRMAN KLASHMAN: What is that? Cultured Clam? and the other is?

MR. LORING: Cultured Clam Corporation. Aquacultural Research Corporation.

We have heard a lot of talk today concerning the preservation of clean water estuaries, etc., but no one here did represent the fish industry, and I feel that it is about time before it is over somebody in commercial fisheries ought to say "please help us". We are trying to develop means of artificially culturing shellfish because of the great population pressures and the reduction in catches. By the same token, we are still in the commercial fisheries, and our entire livelihood as well as the entire industry is based on animals that are caught in the estuaries which are in danger of extinction with poor water quality and the destruction of the marshes. So this is merely a very informal plea. Give us a hand, because if something is not done to protect the water quality we've got and better, perhaps, the quality in other areas, this whole segment of a commercial fishery is going to go down the drain. The protein that we can produce is certainly needed throughout the world, and looking at the New Jersey areas, the Chesapeake areas and the other areas where tremendous shellfish are being put down because of poor water quality, we feel that there is a real danger and a real need for assistance. Thank you.

CHAIRMAN KLASHMAN: Thank you very much. Is there anyone else that wants to be heard? If not, ladies and gentlemen, we stand adjourned. Thank you all very much for coming.

PART II

WRITTEN STATEMENTS

Statement of Charles H. W. Foster

at a Public Meeting on National Estuarine Problems

Federal Water Pollution Control Administration

Boston, Massachusetts

October 8, 1968

My name is Charles H. W. Foster. I am a resident of Needham, Massachusetts, and a former Massachusetts Commissioner of Natural Resources. Both in this capacity and in subsequent positions in national conservation work, I have been privileged to see first hand many of the scientific, administrative and technical problems associated with this study.

At present, I am completing doctoral studies at Johns Hopkins University with special emphasis on the institutional aspects of water resources and river basin management in New England.

Mine has been a life-long interest in estuaries with that rare but fortunate opportunity to translate this interest into actual professional work. I am here this morning because I am convinced that the subject you are considering is one of the most important and most underrated aspects of natural resources in this country today.

A third of our population, and a third of our industrial capacity, is already adjacent to major estuaries. By the turn of the century, one out of every two Americans may be dependent upon the estuaries for a substantial share of his economic and social well-being.

As there will be many others before you today with detailed knowledge of New England's estuaries and their current problems, I would like to focus my remarks exclusively on policy considerations. For discussion purposes these will be grouped into four categories: technical and administrative; planning and regulation; decision making; and organizational structure.

Technical and Administrative

Much has been made of the new frontier represented by the ocean. At a Law of the Sea conference in Rhode Island a few years ago, a number of us were treated to an imaginative presentation by the Franklin Institute's Dr. Athelstan Spilhaus, descriptive of the commercial transportation and even recreational opportunities technologically possible under the ocean.

The fact remains, however, that too much of our institutional and industrial research capabilities have been concentrated on the open ocean. More accurately, too little attention has been spent on the inshore waters which are more immediately productive, offer relatively fewer technological problems, and are politically more viable.

During the early 1960's in Massachusetts, our efforts to improve a badly deteriorating set of relationships among multiple marine interests, revealed one central fact -- so little was known about the resources of the inshore waters that no one interest really knew what it was talking about! The end result was a joining of forces to improve state marine research capabilities, and the creation of a representative policy body which could arbitrate differences without resort to legislative adversary proceedings.

Since those days many new programs have come to pass, mostly under federal auspices. A seeming profusion of grant opportunities are now at hand for which there is vigorous competition among institutions and agencies. The inshore waters, however, are still the weakest link in our chain.

Although our regional, technological and research capabilities have improved materially during the past decade, the effort is far from properly organized. Universities still vie with one another for the available research dollar, losing sight of valuable priorities in the spirit of competition. Only the most tenuous of linkages exist between academia and the marine resources industries and public agencies, the alleged beneficiaries of much of this research. The glamour of oceanographic vessels and facilities tends to sway research administrators from the mundane problems of the winter flounder and the quahog.

New England, however, has made some modest advances in improved coordination. The southern New England consortium of universities sponsored by the University of Rhode Island is one case in point -- also its counterpart in Massachusetts known as MAMS (the Massachusetts Association for the Marine Sciences). The Cooperative Fishery Units at the land grant colleges also appear to have promising potential.

New England is a member of one of the earliest interstate compact commissions, the Atlantic States Marine Fisheries Commission, whose jurisdiction extends from Maine to Florida.

The recently enacted National Sea Grant College Act also bears promise of becoming a useful coordinating device, particularly if it follows through on its stated objective of a fisheries extension effort which can translate scientific findings into understandable and useful practices.

Whatever criticism is applied to the marine resources field, one fact does remain. Few aspects of natural resources are more vigorously alive as evidenced by the effort, the public interest, and even the traditional air of controversy!

Planning and Regulation

Knowing more about estuaries leads inevitably to the question of how they should be used. In actual fact, decisions on usage invariably must be made before all the facts are at hand. In this regard, they appear to have a number of peculiar properties.

Estuaries are generally beset by multiple jurisdictions. Land values are abnormally high due to the industrial and economic development potential. Proximity to people enhances their recreational and aesthetic values. Located at the bottom of a larger drainage system, the estuaries must not only cope with the problems of their immediate surroundings, but often the problems of the watershed above.

All of the above characteristics add up to unusual vulnerability -- and enormous visibility. Estuarine planning and regulation is a truly fish bowl operation. The values contained in most estuarine systems are too valuable to keep unused, and too important to lose through single purpose utilization. The obvious need for broad-based planning and regulation within each major estuary raises immediate questions as to who does the planning and regulation, and for what purposes.

The most logical approach is to start with plans for each individual use component of an estuary -- for example fisheries, industrial development, water quality, etc. -- and then try to bring them together within a balanced, comprehensive plan. The entities responsible for the individual plans must not only have a clear mandate for planning, but also a measure of responsibility (both positive and negative) for implementation.

Numerous precedents are already at hand, including federal-state jurisdictions such as the Delaware River Basin Commission, state regulatory and planning agencies such as New England has now, County Shoreline agencies as in Wisconsin, area jurisdictions such as the San Francisco Bay Conservation and Development Commission, and even local bodies such as town conservation commissions and planning boards.

Decision Making

Given a focus of responsibility of some description there emerges the next question of just how estuarine decisions should be made. Since the stakes are usually inordinately high, the real question is whose ox does one gore!

In my opinion, a fundamental premise should be the consideration of all values from a given estuary regardless of their ability to be measured in economic terms. The initial approach should be to increase the sum total of these values without having to choose one over the other. Thus, an existing identifiable value should have clear precedence over any designed to supplant it. The proposer of a new use should be required to bear the burden of proof that it would assure the continued existence of the other values without appreciable loss or detriment.

Measures which would materially affect public health or safety should be ruled out regardless of the extent or degree of the public involved or the prior duration of the activity. Except in unusual circumstances, such as times of war or disaster, there would seem little reason to risk these traditionally and constitutionally assured priorities.

A third basic premise should be the assignment of a higher priority to programs of short duration and less-than-irrevocable proportions. Man's ability to project ahead substantially and accurately has been discouragingly limited. In consequence, a major objective should be the retention of the maximum number of options for the future.

It would seem particularly prudent to encourage estuarine planning by those capable of implementing the plan. But it would seem manifestly unwise to assign the decision making exclusively to those who plan and implement the proposals. Such an entity must be carefully counterbalanced with less partial interests.

Finally, provision should be made for periodic and impartial reviews of estuarine program activity, preferably in the full glare of the public spotlight. This will help insure not only the correctness of decisions, but also the timeliness of public policies.

Organizational Structure

What sort of framework to use to accomplish these objectives is the final subject of this presentation. It is tempting to recommend a new and revolutionary form of bureaucracy for these purposes but, in my judgment, such an approach should be firmly rejected.

New England and the nation's estuaries should not be federalized. Rather than a new Office of Estuaries in some public agency, containing a full range of administrative and regulatory authority, what we require is a national system of estuarine management as sensitive as possible to local and regional needs. The primary effort should be to eliminate the current confusion, inefficiency, overlap and duplication, both within and between levels of government and, as much as possible, to streamline the management and use of these valuable resources.

The actual administrative entity, its method of operation and its area of jurisdiction, would seem immaterial if the substantive criteria, objectives and goals are shared in common. Consequently, your study should concentrate on a series of guide lines for adequate estuarine management, which among others, might include:

1. Broad representation of estuarine interests.
2. Access to reliable scientific and technical information.
3. Basin considerations.
4. Both framework and detailed planning responsibilities.
5. Regulation of use activities and alteration.
6. Strict public accountability at all times.

Given a set of guiding principles of this sort, it would be up to each estuarine region to devise the actual machinery that would work the best. Among initial approaches, however, I would like to suggest the following.

A focal point of estuarine affairs is badly needed within the federal establishment. I personally feel that no single agency will ever prove satisfactory. The best answer might be a coordinating entity similar to the Water Resources Council, but representative also of the granting agencies, industry, academic, state and local interests. A small central staff would help insure coordination of policies and programs.

A less satisfactory alternative to this approach might be a quasi-government organization, possibly chartered by Congress, with access to resources both within and without government.

But it is within the states themselves that the estuaries have been so often the lonely province of the scientist. In few states are estuarine values properly appreciated by administrators, legislators, political and local leaders. Although problems of deteriorating water quality have begun to sharpen public attention in recent years, the term estuary is hardly a household word.

For the eastern coastal states a good place to begin would be the Atlantic States Marine Fisheries Commission. This interstate compact agency, handicapped by regional divisions, ill-defined program, inadequate support and federal apprehensions, could well become revitalized by a leadership role in estuarine affairs. A broadened marine resources effort by this interstate body would also rub off on its individual members.

At the academic level, the first step would be to reduce the practice of grantsmanship. This process of grants -- for grants'-sake -- is as much encouraged by the federal granting agencies as pursued by the colleges and universities. Much as the various Water Resources Research Center directors have moved toward a regional council for planning and coordination purposes, so the marine-oriented institutions should undertake a joint master plan for research, training, extension and shared facilities in estuarine regions. In the absence of voluntary action, a federal-state agency, such as the New England Regional Commission, might be asked to perform such a function.

Ideally, there should be a conglomerate of separate but related marine and estuarine activities in New England with the maximum possible interchange between the public agencies and their respective academic communities. An enlarged system of state marine experiment stations, adequately coordinated in effort and focused on inshore and estuarine problems, might double as useful training facilities and research stations for university-based personnel, all with considerable savings to the public taxpayer. At the present time New England marine laboratories and research programs seem to bear little relationship to one another, or to the region's real estuarine needs.

Finally, I despair of any real progress without some substantial input from the private sector and the ordinary citizen. An increasing number of important estuarine decisions will be public ones, and an informed and alert constituency must arise to ensure that the right decisions are made.

In this connection, the New England Aquarium Corporation, with its nearly completed display facilities and its broad interest in the world of water, seems to offer unusual promise, both as a means of increasing public understanding and as a catalytic force to bring various interests together.

In conclusion, there is clearly much to be done in the estuarine field. The resources are vital, the issues are growing, and appropriate mechanisms must be found at all levels of government to promptly process and plan the proper use of these valuable areas in the fashion most sensitive to local conditions.

There are, as clearly, sizable hazards ahead. Your study has already been handicapped by interagency rivalries. It runs the further risk of being caught between changing national administrations.

As one who is deeply convinced of the needs in this field, I sincerely hope your recommendations are heeded and hastened.

SCIENTIFIC ANALYSIS CORPORATION

K. C. BLACK, PRESIDENT

33 SUDBURY ROAD
CONCORD, MASS. 01742
TELEPHONE 259-9268
AREA CODE 369-4556
617 358-2675

October 24, 1968

United States Department of the Interior
Federal Water Pollution Control Administration
Northeast Region
John F. Kennedy Federal Building
Boston, Massachusetts 02203

Attention of Mr. L. M. Klashman, Regional Director

SUBJECT: National Estuarine Pollution Study

Gentlemen:

In a letter dated August 27, 1968, I was invited to participate in a public meeting on the impact of pollution on coastal and estuarine waters, which was held in the New England Life Building, 225 Clarendon Street, Boston, on October 8, 1968. I, personally, was in Europe on a business trip at the time of the meeting, but a representative of the Scientific Analysis Corporation attended the meeting. The text of this letter is the result of the notes taken at the meeting and subsequent consideration of the overall problem.

1. General Comments

Pollution costs in Massachusetts estuaries are reflected in everything from peeling paint on houses near some marine cesspools to the loss of shellfish and finfish that will become increasingly important in this protein-short world, whose population continues to explode.

As the discharge rate of pollutants has increased, it has become increasingly evident that contaminants do not dissolve and disappear when refuse-laden river water meets the sea in the estuary. Some estuaries, particularly on the Massachusetts North Shore, have become notorious for their sludge loads. Evidence indicates that tidal action tends to keep pollutants penned in some estuaries, reducing the dissipation rate to a low point that results in concentration rather than dilution. There have been too few investigations into the true nature of what happens in estuaries in general, and far too few investigations of individual estuaries to give one much confidence in applying generalized knowledge to a specific and problematical estuary.

It is to be hoped that this study group will receive enough information on the possible human health hazards related to polluted estuaries so that it can stimulate a serious investigation into this aspect. It is our impression from the few reports and comments pertaining to possible health hazards that far too little is known about this area.

2. Specific Comments

To date the problem of estuarine pollution has not been studied on a quantitative basis, nor has the subject been attacked in a properly scientific manner. On the one hand there is an emotionally charged feeling that "pollution is terrible", which certainly appears to be true from the end result; and on the other there is the attitude of "business as usual", which means that any specific industry or organization will exert every effort to avoid any serious study of the problem, which in the end might result in a financial penalty to their operation.

There are in existence in the United States generally and more specifically in Massachusetts, organizations which are dedicated to scientific attacks on problems such as these and which have no financial stake in the ultimate recommendations which may be made. Such organizations can make quantitative evaluations which would include financial costs of estuarine pollution control, health hazard, and even esthetic value.

If it were possible to avoid an emotionally charged type of report and to concentrate on a scientifically based investigation of the problem, a realistic attack on the matter of estuarine pollution control might result.

3. Suggestions

Since it is practically impossible to study this kind of a problem on a piecemeal basis, it would appear that some sort of federal approval and funding of such a study is desirable, even though specific examples will also fall within the jurisdiction of a particular state or municipality. It is the recommendation of the Scientific Analysis Corporation that the "study" be directed toward the establishment of more than one study contract, adequately funded, with organizations which have no direct financial involvement in the outcome of such studies.

Very sincerely yours,

K. C. Black

KCB:SHW

K. C. Black
President

SCIENTIFIC ANALYSIS CORPORATION

SOUTHEASTERN MASSACHUSETTS
REGIONAL PLANNING DISTRICT

123 NORTH MAIN STREET, FALL RIVER, MASS. 02720 TEL. (617) 678-3991

JOSEPH P. ZORA, Chairman
ROBERT E. STEWART, Vice Chairman
BURTON C. PARKER, Treasurer
LAWRENCE R. FITTON, Clerk
WILLIAM E. BARBOUR, Executive Director

October 28,1968

Mr. John S. Farlow
Regional Coordinator
National Estuarine Pollution Study
North Atlantic Water Quality Management Center
Edison, New Jersey 08817

Dear Mr. Farlow:

The invitation we received from your agency inviting us to participate in a public meeting on the impact of pollution on coastal waters held on October 8 included an invitation to submit a written statement. I was not able to participate in your public meeting and unfortunately have not been able to put together a statement that I think would be useful to you.

Although I had intended to submit a statement before your October 28 deadline I realized that I have no concrete information at this time to benefit your study. Our District is currently doing a two year regional water and sewer master plan study which will undoubtedly provide the kind of information on estuary pollution that you are seeking. At the moment we have just completed the inventory phase of this study and the consultant's inventory report is now being reviewed. I could make a copy of this report available to you if you thought it might contribute to your study of estuaries. However, I think in a few months time we will have more useful information resulting from the analysis and planning phase of this study. If you can wait until then I think we could make a useful contribution. Also currently our District is undergoing reorganization and the staff has been too busy to collect information of the type you suggested.

I might say in summarizing our situation that our regional planning district has at least ten ~~title~~ tidal estuaries listed as follows:

Taunton River and Mt. Hope Bay
Westport River, east and west branch
Slocum River, Dartmouth
Apponogansett River
Acushnet River and New Bedford Harbor

ACUSHNET - ATTLEBORO - BERKLEY - DARTMOUTH - DIGHTON - FAIRHAVEN - FALL RIVER - FREETOWN - LAKEVILLE
MANSFIELD - MARION - MATTAPOISETT - MIDDLEBOROUGH - NEW BEDFORD - NORTH ATTLEBOROUGH - NORTON
RAYNHAM - REHOBOTH - SEEKONK - SOMERSET - SWANSEA - TAUNTON - WAREHAM - WESTPORT

Mattapoisett Harbor
Sippican Harbor
Wewantic River
Wareham River
Onset Bay

The population dwelling in communities located on these estuaries exceeds 300,000 with substantial increases in the summer. The population residing in the drainage basins tributary to these estuaries exceeds one-half million. There is no doubt that these estuaries are one of the most valuable resources of our region, yet because of pollution of untreated domestic and industrial wastes they are providing far less than their full potential in benefits.

I also wish to note that nearly all of the communities adjacent to these estuaries are in the process of planning or constructing new sewage disposal facilities or other improvements to their sewerage systems. These improvements will take a number of years to complete and a vast amount of money, much of which is being provided by the Federal government. It would appear that much of the pollution in our estuaries will be alleviates in time when and as these sewerage facilities are completed. Possibly it is a question of national priorities how soon the problem of pollution of estuaries in coastal waters is corrected. I realize that this is an oversimplified view of this very complex situation and that we need studies such as yours to define the problems and suggest solutions. We undoubtedly need better knowledge of the hydrological forces operating in our estuaries. We also need more knowledge about the affects of chemicals which in recent times have been discharged in increasing quantities into estuaries.

I will be happy to cooperate with you in this important study if your schedule will allow me to contribute something at a later time.

Very truly yours,

William E. Barbour

William E. Barbour
Executive Director

WEB:ac

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASSACHUSETTS 02543
AREA CODE 617-548-1400

October 30, 1968

Mr. John S. Farlow
Regional Coordinator
National Estuarine Pollution Study
North Atlantic Water Quality Management Center
Edison, New Jersey 08817

Dear Mr. Farlow:

Re: National Estuarine Pollution Study

The Woods Hole Oceanographic Institution has long been interested in coastal and estuarine waters and in problems relating to their pollution. Extensive chemical, physical, and biological studies have been undertaken in Great South Bay, Long Island, and Great Pond and Oyster Pond, Falmouth, Mass. Less extensive studies have been made in numerous other locales including Bristol Harbor, Rhode Island, Boston Harbor, Mass., New York Harbor and Long Island Sound, N. Y. In addition, we have been engaged in long-term studies of beach erosion, the residual current system, and the geological resources of the entire continental shelf of Eastern United States.

We have, throughout the history of the Institution, worked closely with the various State and Federal agencies which have been concerned with water pollution and we look forward to the establishment of new programs of mutual interest with FWPCA. At the time of this writing, we have pending three research proposals with your agency, and we anticipate increasing activity along these lines as our contribution to estuarine pollution study.

In connection with the general subject of estuarine pollution, we would like to emphasize the following points:

1. The deleterious effects of heavy and long-term pollution are easily recognized. By that time, however, the damage may be irreparable and the ecological change to the environment irreversible. It is essential, therefore, to recognize pollution in its earliest stages through sensitive and extensive monitoring systems. Additional R and D work is needed for the development of such monitoring systems with the sensitivity and capability of detecting pollution in its many different forms and at its earliest stages. Of equal importance is the training of personnel to employ and maintain such systems as they become available.

2. In addition to the obvious chemical and biological effects of pollution, there are many other, more subtile but perhaps equally damaging effects to the environment. For example, the slow accumulation of pesticides in certain marine fishes may affect reproduction of the entire population. Release of chemicals in minute concentrations (parts per billion) may interfere with natural substances which influence or control such processes as migration, mating, or food location in marine populations. Such cause-and-effect relationships cannot be detected through environmental surveys alone, even after the fact, but require for their elucidation a combination of careful laboratory and field investigation.

3. All man-made alterations or additions to the environment are not necessarily bad. There is good reason to believe that the high levels of shellfish production currently realized in Chesapeake Bay and parts of Long Island are due to the fertilization of these waters by domestic sewage. Thermal alterations resulting from the discharge of industrial cooling-water systems may be lethal in Florida but highly beneficial in New England. Acid-iron wastes dumped in the offing of New York Harbor appear to attract fish for reasons which are not understood. It is therefore essential that the problems of man's interaction with his environment be approached with an open mind and with a positive attitude rather than the purely negative philosophy usually implied by the term "pollution".

Promising research is underway in California in which algae are being grown in sewage wastes and harvested for cattle feed, with astounding yields. Oyster growers are experimenting with the culture of oysters in the heated cooling waters of a local power company. It is our opinion that FWPCA should concern itself with those potentially constructive and beneficial applications as well as the purely negative aspects of pollution.

4. We believe that we can, at present, more readily predict both long and short-term changes in the deep-sea environment than in the estuaries, where the greatest ranges and most rapid changes in temperature, salinity, dissolved oxygen, nutrient chemicals, and current speeds occur and where there is great variability from place to place. A true understanding of the estuarine environment of the entire U. S. coastline requires an investigative program of an intensity and sophistication which is well beyond the present manpower capabilities of this country.

We are encouraged by the vigorous local estuarine survey program being conducted by the Massachusetts Department of Marine Fisheries and are aware of similar programs by both State and Federal agencies being conducted elsewhere. More of this type of work needs to be carried out. Additional financial support as well as training programs to provide the needed manpower are essential for achieving these objectives.

5. Surveys of estuarine areas, evaluation of beneficial or harmful effects of human alteration, determination of tolerances and more subtile biological effects are not tasks which one or two agencies or institutions can accomplish alone. We would suggest that schools, colleges, and universities located near the coast which are developing programs in the marine sciences be made constantly aware of their opportunities for developing educational and research programs in the estuarine area. Locally, through the Massachusetts Association of Marine Science, an affiliation of Massachusetts colleges, we believe that we can recruit excellent resources for research in these endeavors.

Sincerely yours,

John H. Ryther
Chairman
Department of Biology

JHR:ahg

Remarks made at public meeting on

Impact of Pollution on Coastal and Estuarine Waters

October 8, 1968 Boston, Mass.

My name is Donald R. F. Harleman, Professor of Civil Engineering at the Massachusetts Institute of Technology. I am associated with the Hydrodynamics and Water Resources Division of the Department of Civil Engineering, where I am in charge of teaching and research in the field of water quality.

M.I.T. has had a long history of education and research in the area of water pollution control. Much of this activity has been supported by the Federal Water Pollution Control Administration and its predecessor the Public Health Service. I am firmly of the opinion that the university research grant program of the F.W.P.C.A. is one of the most effective national programs for advancing our ability to achieve control of pollution. I would urge the Congress to continue an expanding program of university research grants. The important dual benefits of this activity should be recognized in the sense not only of research accomplishment, but of attraction and training of engineers to the field.

Our present research program is centered around the determination of the distribution and decay of pollutants discharged into lakes, rivers, estuaries and coastal areas. In addition to the consideration of municipal and industrial wastes, heated effluents from thermal and nuclear power plants are also under study. One of the F.W.P.C.A. supported research programs is investigating the fate of pollutants discharged into the Potomac and James River estuaries of Chesapeake Bay. This study involves an advanced level of mathematical modelling in which the convective effect of the instantaneous, non-linear tidal velocities are considered. The complete momentum and mass balance equations are solved on a digital computer to give a description of water quality parameters as a function of time and distance for multiple input locations.

In terms of local problems, we have recently completed a model investigation of the temperature distribution resulting from heated condenser water discharge from a proposed nuclear power station on Cape Cod Bay. The effect of population development on pollution problems in Boston Harbor is also under active study.

A list of recent publications relating to research on estuary pollution problems follows:

1. D. R. F. Harleman and J.A. Hoopes, "The Prediction of Salinity Intrusion Changes in Partially Mixed Estuaries", Proceedings of the 10th Congress, International Association for Hydraulic Research, September, 1963.

2. D. R. F. Harleman, "The Significance of Longitudinal Dispersion in the Analysis of Pollution in Estuaries", Proceedings 2nd International Conference on Water Pollution Research, Tokyo, August, 1964, (Pergammon Press).

3. D. R. F. Harleman, E. R. Holley, Jr., and W. C. Huber, "Interpretation of Water Pollution Data from Tidal Estuary Models", Proceedings of Third International Conference on Water Pollution Research, Section III, Paper No. 3, Munich, September, 1966, (Pergammon Press).

4. D. R. F. Harleman and G. Abraham, "One-Dimensional Analysis of Salinity Intrusion in the Rotterdam Waterway", Delft Hydraulics Laboratory, Publication No. 44, October, 1966.

5. D. R. F. Harleman, L. F. Corona and E. Partheniades, "An Analysis of Salinity Distribution in the Straits of Maracaibo", Proceedings of the 12th Congress, International Association for Hydraulic Research, Ft. Collins, September, 1967.

6. D. R. F. Harleman and C. H. Lee, "Numerical Studies of Unsteady Dispersion in Estuaries", Proceedings A.S.C.E., Vol. 94, No. SA5, October, 1968.

7. D. R. F. Harleman and A. T. Ippen, "Two-Dimensional Aspects of Salinity Intrusion in Estuaries: Analysis of Salinity and Velocity Distributions", Technical Bulletin No. 13, Committee on Tidal Hydraulics, Corps of Engineers, Vicksburg, June, 1967.

8. D. R. F. Harleman, L. C. Hall and T. Gray Curtis, "Thermal Diffusion of Condenser Water in a River During Steady and Unsteady Flows with Application to the T.V.A. Browns Ferry Nuclear Power Plant", Technical Report No. 111, Hydrodynamics Laboratory, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Mass., September, 1968.

STATEMENT OF HOWARD WHITMORE, JR.

COMMISSIONER, METROPOLITAN DISTRICT COMMISSION
FOR THE NATIONAL ESTUARINE POLLUTION STUDY
CHARTER ROOM, NEW ENGLAND LIFE BUILDING
BOSTON, MASSACHUSETTS
OCTOBER 8, 1968

AT THE BOSTON HARBOR ENFORCEMENT CONFERENCE, HELD IN HISTORIC FANEUIL HALL LAST MAY, I STATED THAT THE METROPOLITAN DISTRICT COMMISSION'S AMBITIOUS POLLUTION CONTROL PROGRAM HAS MADE GREAT PROGRESS IN RESTORING BOSTON HARBOR AND ITS THREE MAIN RIVER TRIBUTARIES, THE CHARLES, THE MYSTIC, AND THE NEPONSET, TO THE BENEFIT AND ENJOYMENT OF METROPOLITAN BOSTON'S CITIZENS. SINCE THAT MEETING, WITH THE INITIAL OPERATION OF THE DEER ISLAND TREATMENT PLANT, THE DEPARTMENT OF PUBLIC HEALTH HAS REOPENED CLAM FLATS IN BOSTON HARBOR AND FOR THE FIRST SUMMER WITHIN RECENT MEMORY THERE WERE NO THREATS TO CLOSE ANY OF THE BATHING BEACHES DUE TO POLLUTION FROM EITHER OF THE COMMISSION'S NUT AND DEER ISLAND SEWAGE TREATMENT PLANTS.

RESIDENTS OF METROPOLITAN BOSTON ARE INDEED FORTUNATE TO HAVE, CLOSE AT HAND, MANY MILES OF OCEAN SHORELINE IN CONTRAST TO THAT AVAILABLE TO THE PEOPLE OF MOST OTHER DENSELY POPULATED AREAS OF THE COUNTRY.

ABOUT 100 MILES, OR 5% OF THE 2,000 MILES OF OCEAN COASTLINE IN MASSACHUSETTS ARE PUBLICLY OWNED. TWENTY MILES OF THIS PUBLICLY OWNED OCEAN FRONTAGE ARE IN STATE OWNERSHIP AND THE REMAINING 80 MILES CONTROLLED BY MUNICIPALITIES. PUBLIC OCEAN AND BAYSIDE BEACHES IN THE BOSTON METROPOLITAN AREA ARE PRIMARILY DAY-USE RECREATIONAL BATHING AND SWIMMING FACILITIES. WE ESTIMATE THAT OVER TWELVE MILLION PEOPLE UTILIZE THE COMMISSION'S SALT-WATER BEACHES DURING THE RECREATIONAL SEASON.

IN 1904, THE CHARLES RIVER BASIN WAS CREATED BY THE ERECTION OF A DAM AT THE MOUTH OF THE RIVER. THE BENEFICIAL IMPACT OF THIS BASIN ON THE DEVELOPMENT OF THE ADJACENT AREAS AND METROPOLITAN BOSTON IS OBVIOUS TO EVERYONE. THE COMMISSION RECENTLY COMPLETED THE AMELIA EARHEART DAM NEAR THE MOUTH OF THE MYSTIC RIVER.

THE FUTURE VALUE OF THIS BASIN, UPON COMPLETION OF SOME MORE DEVELOPMENT WORK, GIVES EVERY INDICATION TO BE AS GREAT AS THE CHARLES RIVER BASIN. PRELIMINARY PROPOSALS FOR THE ERECTION OF A DAM AT THE MOUTH OF THE NEPONSET HAVE BEEN MADE BY INTERESTED PARTIES AND WHETHER A FINAL STUDY WILL INDICATE THAT A DAM SHOULD BE ERECTED OR NOT IS NOT KNOWN AT THIS TIME.

THE COMMISSION BELIEVES THAT THE CONTROL OF THESE RIVER ESTUARIES, IN A METROPOLITAN AREA, CAN BEST BE ACCOMPLISHED BY CENTRALIZING THE AUTHORITY IN ONE GOVERNMENTAL AGENCY LIKE THE METROPOLITAN DISTRICT COMMISSION. THE PROBLEMS OF EROSION, POLLUTION, DEVELOPMENT, MAINTAINING AND CONTROLLING ESTUARIES IN A METROPOLITAN AREA ARE FAR MORE COMPLICATED AND COMPLEX THAN IN A RURAL AREA. THE MANY LOCAL, STATE, AND FEDERAL AGENCIES CONCERNED WITH THE CONDITION OF BOSTON HARBOR AND ITS TIDAL ESTUARIES INDICATE A NEW AWARENESS OF THE CONCERN THAT PEOPLE FEEL FOR THE PROPER MAINTENANCE AND CONDITIONS OF ALL WATERS, BOTH SALT AND FRESH.

WITH FULL REALIZATION OF THE TREMENDOUS IMPORTANCE THAT CONTROL OF OUR ENVIRONMENT HAS ON THE HEALTH AND WELL-BEING OF SOCIETY IN GENERAL AND ON METROPOLITAN CITIZENS IN PARTICULAR, THE METROPOLITAN DISTRICT COMMISSION LAUNCHED A HUGE POLLUTION CONTROL PROGRAM IN 1945 THAT IS NOW IN THE FINAL STAGES OF COMPLETION. INITIAL POSITIVE RESULTS WERE EVIDENT IN THE SUMMER OF 1951 WHEN THE EFFLUENT FROM THE THEN RECENTLY COMPLETED NUT ISLAND SEWAGE TREATMENT PLANT WAS CHLORINATED AND LONG STANDING PUBLIC HEALTH HAZARDS IN THE QUINCY SHORE AREAS WERE ELIMINATED. SHORTLY THEREAFTER, A DANGEROUS PUBLIC HEALTH HAZARD IN THE VALLEY OF ALEWIFE BROOK WAS BROUGHT UNDER CONTROL BY CONSTRUCTION OF A PUMPING STATION. DURING THE SUCCEEDING YEARS, OTHER COMPONENTS OF THE PROGRAM WERE PUT INTO OPERATION AS THEY BECAME AVAILABLE AND, AS I ANNOUNCED AT THE BOSTON HARBOR ENFORCEMENT CONFERENCE LAST MAY, THE LARGEST AND MOST IMPORTANT FACILITY OF THE ENTIRE PROGRAM, THE DEER ISLAND SEWAGE TREATMENT PLANT, BECAME OPERATIVE.

MUCH HAS BEEN ACCOMPLISHED, YET ADDED PROJECTS MUST BE UNDERTAKEN IN THE FURTHERANCE OF THE OVERALL CONTROL PROGRAM. INFORMATION IS URGENTLY NEEDED BY AGENCIES SIMILAR TO THE METROPOLITAN DISTRICT COMMISSION ON HOW BEST TO CONTROL

THE ESTUARINE WATERS, ESPECIALLY IN A METROPOLITAN AREA. DETAILED INFORMATION IS NEEDED ON THE FERTILIZATION EFFECT OF THE DISCHARGE OF TREATED EFFLUENT INTO A MARINE ENVIRONMENT.

DETAILED INFORMATION IS NEEDED ON THE VARIOUS CONDITIONS OF WATER MOVEMENT AND BOTTOM TOPOGRAPHY.

DETAILED INFORMATION IS ALSO NEEDED ON THE EFFECTIVE MIXING OF TREATED EFFLUENTS AND SEA WATER AND THE PROBABLE EFFECTS ON THE RECEIVING WATER.

PARAMETERS MUST BE ESTABLISHED BY RESPONSIBLE AGENCIES THAT ARE REALISTIC AND ATTAINABLE WITHIN THE ECONOMIC FRAMEWORK OF TODAY'S SOCIETY.

THE WIDE AND PROMPT DISSEMINATION OF THE RESULTS OF THIS 'ESTUARINE STUDY' BEING CARRIED OUT BY THE UNITED STATES DEPARTMENT OF THE INTERIOR, F.W.P.C.A. WILL BE OF SUBSTANTIAL ASSISTANCE TO AGENCIES LIKE OURS. WE ENTHUSIASTICALLY AND EAGERLY JOIN WITH YOU. ALL OF OUR FACILITIES AND EXPERIENCE ARE AVAILABLE IN OUR COMMON TASK TO CONTROL ESTUARIES FOR THE BENEFIT AND ENJOYMENT OF EVERYONE.

AMC
APPALACHI
FIVE JOY STREET, BOSTON, MASSACHUSETTS 021

October 8, 1968

Lester M. Klashman, Regional Director
Federal Water Pollution Control Administration
% Public Meeting
Charter Room, New England Life Building
Boston, Massachusetts

Dear Mr. Klashman:

The following statement is submitted for inclusion in the written record of October 8th meeting on behalf of the Appalachian Mountain Club, 5 Joy Street, Boston, Massachusetts 02108, the oldest mountain public service organization in this hemisphere and founded in 1876. The Club has a long and distinguished record of interest in the natural resources of this country, and in particular New England. We have been and are a member of many local and regional conservation councils and associations including the Massachusetts Conservation Council.

For a good many years among the varied activities of our Club has been an active program of both flat and white-water canoeing, some of it involving tidal rivers and basins. Our expertise in this field includes the publication of a comprehensive 563 page New England river guide entitled "The A. M. C. New England Canoeing Guide, A guide to the canoeable waterways of New England." Since this book is a reasonably complete inventory of these rivers, we are pleased to submit with this statement three copies of the latest 1968 edition for the future work of your commission.

We especially call your attention to that part of the Introduction under "Conservation" on pages x and xi in the front. In addition please note the section entitled "Rhode Island - Massachusetts Coast" starting on page 426. From this section we submit the three following brief descriptions of Massachusetts tidal rivers to point out the beauties as well as the ugliness of our coastal estuarine problems:

HERRING RIVER - Page 461

" - -'-The Herring River is a tidal estuary as far up as the fish ladder at the end of the unnamed pond

> just south of the railroad tracts. - - - Above this point it is a freshwater stram with negligible current. - - - - Since much of the navigable portion is tidewater, it is advisable to pick a favorable tide, and a round trip makes a good day's outing."

NORTH RIVER - Pages 466-67

> " - - - A pleasant day's canoeing may be enjoyed by using the ebb tide to run down the river in the morning, picknicking on the beach near the mouth and returning up stream on the flood tide. A variation of this would be to return up the South River (q.v.) to Marshfield."

NEPONSET RIVER - Page 470

> " The Neponset River rises in Foxboro and flows north into Dorchester Bay in Boston Harbor. Formerly a pretty stream it has been much spoiled by pollution and urbanization, so that there is today little to recommend it for canoeing other than its proximity to Boston. It is best run in the spring, but surprisingly enough much of it can be run at other seasons."

This publication has found extensive use and acceptance by the canoeing public in the northeast. It has been widely reviewed in many outdoor publications. The following excerpts from a review in MAZAMA, September 1968, the monthly journal of Oregon's largest mountain Club, clearly states the problem that faces all concerned officials, groups and individuals on improving the future of New England's rivers and their intinately-related coastal estuarine areas.

> " There is a certain kind of nut who enjoys reading out-of-town telephone books, pouring over street map of places like Wheeling, West Virginia or Rio de Janeiro, or studying climber's guides to mountains that they know they will never see. To this kind of nut, I highly recommend the A. M. C. New England Canoeing Guide (Appalachian Mountain Club, 2nd edition, 1968)."

> " At the same time that it is an overall guide to its subject, this book is a description of it, an encyclopaedic review of all the major waters that drain one region of the United States. After only a little browsing, one begins to be aware of a terrible truth: the waterways of New England, taken as a whole, are in a foul and dismal state. They are dammed, choked, polluted, hemmed in with concrete, closed over by

bridges, used as dumps and garbage pits, or made erratic in their flow by deforestation. It may be possible to open the book to one of its 550 pages and not find the word "dam," but it is not easy."

" It is tempting for an Oregonian to feel smug. Back there they don't care about their rivers. They are stunted in spirit and ugly in soul, and have degraded their rivers to mirror themselves. Yet we should not forget that they have been camped on their landscape some 200 years longer than we. We are fortunate that we have a margin of time left for despoiling our waterways. We started late, but we are working hard at it."

" Perhaps as long as there are as many as six miles of "very attractive" river left in Rhode Island (I counted them on the map), there is wilderness. But what will happen when all the rivers everywhere have been dammed, all the waterpower harnessed, and all its flow gone underground into pipes and sewers?"

Sincerely yours,

Abigail D Avery
Abigail D. Avery
Chairman, Conservation Committee

C. Francis Belcher
C. Francis Belcher
Executive Director

The Commonwealth of Massachusetts
Metropolitan Area Planning Council
44 School Street, Boston 02108

TELEPHONE 523-2454

October 9, 1968

Mr. John S. Farlow
Regional Coordinator, National
  Estuarine Pollution Study
North Atlantic Water Quality
  Management Center
Edison, New Jersey   08817

Dear Mr. Farlow:

In reference to your letter inviting our participation in a public meeting on the impact of pollution on coastal and estuarine waters, the Metropolitan Area Planning Council is pleased to register the following statements:

1. The Metropolitan Area Planning Council is the state agency charged with the responsibility for comprehensive regional planning including open space and recreation planning for the Boston metropolitan area. The Council has prepared a plan and program for Boston Harbor including the shoreline from Winthrop to Hull, and the Harbor islands.

2. Boston Harbor is the most spacious recreational area in the region and the one closest to the most densely populated areas of metropolitan Boston. Revitalization of the Harbor would offer unlimited recreational opportunities for residents of the urban core.

3. The Council, in its Open Space Program, has established several major goals relative to Boston Harbor: to assure that future uses of harbor lands and islands will be appropriate to their unique location; to conserve and protect the coastline and related land and water resources; to restore and protect the water quality in the Harbor; to provide access to the shore with emphasis on pedestrian access to the

water's edge; to acquire or protect salt marshes and their related wetlands; to control shore development in such a way as to enhance the Harbor's inherent beauty; and to develop recreational areas suitable to shore locations.

4. In order to protect and develop Boston Harbor, a program of water quality control must be continued. The Metropolitan Area Planning Council has endorsed the Water Resources Commission's B rating for Boston Harbor (excluding the Inner Harbor) and its estuarine waters. This classification would make Harbor waters suitable for all water contact sports, agricultural and certain industrial cooling and processing uses, fish and wildlife habitat, and excellent aesthetic value.

5. In order to best utilize the Harbor's scenic and natural resources, the Council recommends that a program of pollution abatement be undertaken on local, state and federal levels. The following participants can be particularly instrumental in an effective program of this type.

   a. Each city and town adjacent to the Harbor should establish waterfront districts as part of its zoning bylaws as a protective measure in regulating land uses along the shore. The bylaws should contain setback and landscaping requirements, a design-review procedure, and other controls common to zoning ordinances.

   b. The Department of Natural Resources should continue its responsibility for a vigorous pollution abatement program. In addition, the DNR should make its technical resource management expertise available to other agencies concerned with development of shore areas, and as much as possible encourage interagency cooperation.

   c. The Department of Public Works through its Division of Waterways has the responsibility for the planning, construction and control of beaches, harbor improvement and other ocean and inland projects. Harbor pollution control should be included in all future programs.

d. The Massachusetts Port Authority has a responsibility to the entire Harbor area and its adjacent communities to encourage maximum efficient and attractive use of an outstanding resource.

e. The Metropolitan District Commission has made recent achievements in pollution abatement by constructing two sewage treatment plants, one at Nut Island, the other at Deer Island. Although both are completely operational, the MDC alone cannot adequately treat the pollution problem in Boston Harbor.

f. Local groups through cooperation, participation and support can help to initiate necessary legislation and financing of anti-pollution program. In addition, they would be beneficial in assuring that public programs are responsive to private and individual needs.

6. The success of pollution control, will depend largely on public support for programs ranging from costly sewage treatment to proper sanitary devices in small craft. Other costs will include modern solid waste disposal services, clean and efficient port development, and control over illegal dumping and filling.

Federal and State funds are available to local conservation commissions for the protection of coastal wetlands and other important resources.

We feel that Boston Harbor and its associated islands could offer unmatched recreational opportunities to the region which it serves. In order to realize its full potential, a continued program of water quality control for Boston Harbor and its estuarine waters is essential. Improvement and recreational development will not be possible without this initial step.

The Metropolitan Area Planning Council is pleased to have participated in your forum on pollution abatement, commends your efforts to include all agencies and interested groups in this discussion of mutual concern, and urges immediate action to restore full use of this irreplaceable resource.

Sincerely yours,

Robert G. Davidson

Robert G. Davidson
Executive Director

RGD:cp

BOSTON EDISON COMPANY

An investor-owned electric utility serving more than one and one-half million people in the forty cities and towns which comprise Metropolitan Boston.

This is a statement for a public meeting on the impact of pollution on coastal and estuarine waters in Massachusetts. This meeting is sponsored by Federal Water Pollution Control Administration, National Estuarine Pollution Study, at Boston, Massachusetts, October 8, 1968.

Gentlemen, I am Francis L. Archibald, a registered professional engineer in the Commonwealth of Massachusetts, and I am the Environmental Engineer for the Boston Edison Company.

The coastal and estuarine waters and their resources are vitally important to everyone and must be kept in good usable condition. Boston Edison Company's particular use of these waters is to provide abundant cooling water for our power stations and also to provide navigable waterways for fuel delivery.

We are concerned with the quality of the water available to us. We are equally concerned with maintaining the quality of this vital water so its identity as a valuable resource will not be destroyed and so it will be suitable for use by others.

Growth of electric load and need for more generating stations means increased usage of the natural resources to meet the electrical requirements of the people we are committed to serve. Because of varying local conditions, regulation of water quality should be vested in the smallest jurisdiction - local, state or regional - capable of accomplishing the desired purpose. Necessary regulations and quality standards should be established only after careful determination and evaluation of the facts and in light of control methods that are technically and economically feasible and fair to all.

With a spirit of cooperation and support, Boston Edison Company is in accord with the overall objectives of the National Estuarine Pollution Study.

CAPE COD
PLANNING AND ECONOMIC DEVELOPMENT COMMISSION

COUNTY OF BARNSTABLE MASS

BOX 23
HYANNIS, MASS. 02601
TELEPHONE: 775-3532

October 8, 1968

Mr. John S. Farlow
Northeast Regional Office, FWPCA
North Atlantic Water Qual. Man. Cen.
Edison, New Jersey 08840

Dear Mr. Farlow:

I am enclosing herewith two papers which are being submitted as a matter of record for the National Estuarine Pollution Study. One of the papers entitled Impact of Pollution on our Coastal Waters has been prepared at my request by the shellfish warden of the Town of Falmouth, a Mr. Souza, whom you might be interested in contacting directly. He is extremely knowledgeable about the matter of estuarine pollution in the Town of Falmouth and has been engaged in a continuous dialogue with local and state officials on the problems in his community.

The second paper designated as Technical Report, #1 was prepared by me in the fall of 1967 and as a form of reaction on the part of the Commission to the Water Quality Standards recently adopted by the Massachusetts Division of Water Pollution Control. I would direct your attention specifically to pages nine thru eleven which summarizes the problem of pollution in our estuarine areas on Cape Cod. Let me, at this time, summarize the remarks made in that report.

1. Pollution is minimal on Cape Cod at the present time.
2. The pollution of estuarine areas is attributable to two major sources.
    (a) Lack of adequate public sewerage systems in selected areas where urban development is precipitating measureable pollution of adjacent estuarine waters.
    (b) Sewerage waste water, solid refuse and oil and gas residues deposited in the estuarine waters directly by pleasure watercraft.
3. The type of pollution identified under item (a) above is capable of being solved at the local level and is, in fact, being solved currently.
4. Pollution identified under item (b) is capable of only being partially solved at the local level; this would embrace such measures as the construction of on-shore sewerage disposal facilities to directly serve pleasure watercraft and strict enforcement of present ordinances dealing with the offenses of said pleasure watercraft.

5. That part of the estuarine pollution problem which cannot be solved at the local level is the matter of the mandatory installation of suitable watercraft waste treatment and/or control facilities installed by the manufacturer directly on the watercraft. (see Watercraft Waste Disposal statement enclosed herein).

6. There remains a further aspect of the estuarine pollution problem which is emerging and whose solution cannot, as yet, be properly assigned to either the local or federal level--the contribution of gas and oil residues to esturine pollution and more, particularly, their effect upon finfish, in general, and on shellfish, specifically.

I trust that the information included herein will prove meaningful to your studies and I would appreciate, whenever appropriate, further correspondence and dialogue on the subject.

Very truly yours,

E. Fletcher Davis

E. Fletcher Davis
Executive Director

EFD:bc
enc.

TECHNICAL REPORT NUMBER I
September 27, 1967

WATER QUALITY STANDARDS

A Brief Background Statement
on the
Massachusetts Pure Water Program of 1966
A Cursory Analysis of the Degree
of
Water Pollution on Cape Cod

TABLE OF CONTENTS

Section I: Background - 1

A. Legislative- 1

B. General Policies - 1

C. Procedure for Follow-Up of the Implementation Program- - - - 2

D. Surveillance Program - 3

Section II: The Nature of the Water Pollution Problem on Cape Cod - - - 4

A. Existing Conditions- 4

B. Implications and Conclusions - - - - - - - - - - - - - - - - - 9

Appendices

1. Summary of Remarks of Cape Cod Residents and/or Organizations at the Public Hearing on Coastal Waters

2. Watercraft Waste Disposal

3 Newspaper Article NAEBM

SECTION I. BACKGROUND

The following information has been extracted verbatim from a publication of the Water Resources Commission entitled: Volume I - Water Quality Standards, Laws, Policy & Standards, dated June 20, 1967.

A. Legislative

"On September 6, 1966 the Massachusetts Legislature enacted Chapter 685 creating the Division of Water Pollution Control under the Water Resources Commission in the Department of Natural Resources to administer and enforce all of the requirements of a comprehensive State water pollution control program.

"Chapter 687 provides for a 10 year $150 million dollar bond issue to complement available Federal construction aid to assist the local communities in constructing required waste treatment facilities." (This chapter has been revised and is presently being discussed in the Senate; the revision in the bill or chapter provides for monies to be advanced to communities for final plans.)

"Chapter 700 calls for a workable exemption from the local property tax for any real or tangible personal property used for waste treatment purposes by industry. (adopted)

"Chapter 701 allows an accelerated depreciation allowance for state corporate tax purposes for the capital investment made by a corporation in an approved waste treatment. (adopted)

"The provisions of these four legislative acts are presently being implemented by the Division of Water Pollution Control and are in consonance with the basic intent of the Federal Water Quality Act of 1965 and the Clean Waters Restoration Act of 1966."

B. General Policies

The following general policies of the Division of Water Pollution Control are as follows:

"1. Classification of all waters of the Commonwealth is for the express purpose to establish water quality goals commensurate with the anticipated future uses of the subject water and also that considered attainable by superior technological programs of waste treatment. The classifications designated in the submission to the Secretary are considered to be those that will be attained over the first phase of this program or within a five to seven year period depending on the availability of federal appropriations.

"2. All waste sources on fresh waters will be required to be treated to the secondary level regardless of the stream classification assigned. Secondary treatment will generally refer to biological treatment as applicable and/or its industrial wastes treatment equivalent all as determined by the Division of Water Pollution Control. Secondary treatment efficiencies shall range from 80 to 95% BOD removal with correspondingly similar removals on other waste parameters. On coastal and marine waters the degree of treatment required will be that which will attain the particular classification set on the area waters."

"3. Tertiary treatment may be required where the estimated increased beneficial water uses can be shown to be economically justifiable. Classifications are not to be considered as immutable. After waste treatment facilities are instituted continuing programs of surveillance combined with improvements in technology may indicate reclassification to a higher use class should be made.

"4. Classification review on D and C streams will be made after completion of the first phase of this program. Classifications shall be made on wet weather considerations in regard to bacteriological control in order to provide the maximum amount of protection insofar as the public is concerned.

"5. The Massachusetts compliance program will be tied to a chronological time period associated with those amounts of federal and state aid that is made available.

"6. Section 27 of Chapter 685 describes the responsibilities of the Division in regards to comprehensive planning for water pollution control.

"7. It is the policy of the Division whenever low classifications are encountered, the application of which was required by particularly difficult technological problems, that research and development funds expended to provide for the upgrading of those waters so classified.

"8. Where serious water quality control problems are the result of low dependable flows consideration will be given to the need for and value of storage for waters to be used for low flow augmentation, contingent upon the requirements of Section 39, of Chapter 685 of the Massachusetts Acts of 1966."

C. Procedure for Follow-Up of Implementation Program

"1. Each polluter listed in the plan of implementation will be informed in writing of the provisions of the Massachusetts Clean Waters Act and the schedule established by the Division for the abatement of pollution. Each will be required to indicate in writing their agreement to proceed with the program in accordance with the schedule.

"2. In the event of failure of the polluter to indicate their agreement with the schedule, or failure or to subsequently fail to comply with the schedule, the Division will take appropriate action under the provisions of the Massachusetts Clean Waters Act to effect compliance.

"3. If it is shown that any scheduled date or dates cannot be met because of circumstances beyond the control of the polluter the schedule will be adjusted and the Federal Water Pollution Control Agency so notified."

"4. If subsequent investigation or surveys disclose a relevant source of pollution, the source will be added to the plan and the Federal Water Pollution Control Agency so notified.

"5. A potential source of pollution (municipality) may be added if preliminary reports show that a sewerage and treatment facility are needed to prevent the degradation of the waters of the Commonwealth."

D. Surveillance Program

"The maintenance and protection of the quality of the waters of the Commonwealth of Massachusetts during the water pollution control implementation phase can only be assured by a meaningful surveillance program. The Massachusetts surveillance program will be divided into 3 specific areas of concentration in order to provide a comprehensive, intensive and meaningful program for the protection of our vital resources. The 3 areas of concentration are complementary in nature and are described as follows:

"1. Stream Surveys

Stream surveys will be organized and operated on a seasonal basis in areas where water quality information is lacking or out of date. The primary function of these surveys will be to ascertain what type and degree of treatment will be required for attainment of the water quality classifications and standards adopted on the subject waters. It is anticipated that 2-4 such sanitary surveys will be made a year during the critical dry weather period.

"2. Waste Treatment Plant Surveillance

A second and integral part of the Massachusetts surveillance program will be the supervision of the operation of all waste treatment works.

Analyses of waste treatment effluents will be made on a routine basis for Dissolved Oxygen, Biochemical Oxygen Demand, pH, alkalinity, and solids in accordance with the latest and most recent acceptable standard methods. In certain specific cases CN^{--}, Cr^{+6} or other analyses may be run as is required. District engineering personnel will be responsible for the general operation of waste treatment plants and routine analytical results and operational data will be submitted to the central engineering office through the district engineers.

"3. Automatic Water Quality Monitoring Systems

A stream surveillance program utilizing automatic water quality monitoring equipment including a data logger system will be employed where previously instituted abatement programs have resulted in the construction of waste treatment works and the critical downstream water uses being protected justify a continuous record of upstream water quality. It is anticipated that 6 robot stations will be employed for fiscal year 1968 having 6-7 parameters and telemetering to a headquarters located data logger system.

SECTION II. THE NATURE OF THE WATER POLLUTION PROBLEM ON CAPE COD

A. Existing Conditions

During the past several months, correspondence has been engaged in and/or discussions held with various Town officials and the Barnstable County Board of Health for the purposes of clarifying the degree of water pollution on the Cape. The information derived from this activity is summarized below by Town.

1. Bourne

An article in the Falmouth Enterprise on Friday, September 8, 1967 describes the fact that no pollution exists in the Town of Bourne at the present time. The Shellfish officer also reported that no areas were closed to shellfishing.

"Board of Health office has reported that tests taken twice a month during the summer season, as is customary in Bourne, have shown that the waters of Bourne have been free from pollution.

"In spite of the fact that marinas and moorings were crowded with boats much of the time because of the poor weather tests taken by technicians of the county laboratory in the waters and along the beaches from the Falmouth line in Cataumet to Hideaway village at the Wareham line have shown most satisfactory results. Residents of Pocasset area had expressed concern from time to time with possible pollution of Barlows river because of the heavy boat population in the somewhat limited waters, however the test results in this river have continuously shown excellent reports.

"The only exception to this situation was at one small fresh water pond in the Queen Sewell area of Buzzards Bay which was contaminated for a short time. The source was discovered and corrected immediately and the condition cleared up, making the pond again available for use before the close of the season."

With respect to the Cape Cod Canal, the Barnstable County Board of Health is of the opinion that there presently exists no measurable degree of pollution in its waters. Some four years ago, immediately prior to the Town's constructing a swimming pool adjacent to the Canal in Buzzards Bay (which is served via a tidal gate on the Canal), the County Board of Health conducted extensive tests of the Canal waters and found little or no pollution. Tests are conducted regularly of the water in the pool itself it is found to be free of contaminants.

The Water Resources Commission has classified the Canal as SB and proposed it to remain at SB. No shellfishing activities are permitted in the Canal per order of the Corps of Engineers.

2. Sandwich

The Old Harbor Creek and Dock Creek have been closed to shellfishing (and condemned) by the State Department of Health because of an unreasonable degree of pollution. The problem is attributable to seepage from cesspools serving both residential and commercial users in the area. There is also a situation where a certain commercial use directly pipes its effluent into an adjacent creek. The present condition in terms of the water quality standard is SB according to the Water Resources Commission.

3. Falmouth

There are three areas in Falmouth which are closed to shellfishing for reasons of contamination. Falmouth Harbor, some 40 acres; Little Harbor, 38 acres and Eel Pond, 6 acres. There are also five areas closed to shellfishing but for propagation reasons and much of the propagating is being done with shellfish which has been transplanted from the contaminated areas.

Those areas closed to shellfishing because of the propagation reasons are Green Pond, Great Pond and Perch Pond, Quisset Harbor, Wild Harbor River and Bay Shores and Fresh Pond.

Eel Pond, which is in back of the Oceanographic Institute and accessible from the water only via a drawbridge, has just recently been found to be free of any pollution by the County Board of Health. Apparently, the problem was primarily attributable to seepage from the cesspools in the area and they have been rebuilt. Thus, the area could probably be opened up to shellfishing again. The Water Resources Commission had classified it SB and had proposed a standard of SA.

Little Harbor, while it is also a recreational boating harbor, has a pollution problem that is primarily attributable to the U. S. Coast Guard vessels. These ships serve as temporary quarters for the crew when they are in port. Apparently, sewage is released into the water from the ships regularly and possibly unavoidably. The State classifies this body of water as SB and proposes it be upgraded to SA.

Falmouth Harbor, classified by the State as SC and proposed for upgrading to SB is the major pollution problem in the Town. While possibly some seepage from cesspools exists on the perimeter of the harbor, the Selectmen are convinced that the major pollution is primarily attributed to boats flushing their heads and disposing of refuse overboard, and secondarily, to the heavy deposits of oils and gas residues. Pollution decreases substantially during the winter months when the harbor is idle as a recreational port.

4. Mashpee

There is no discernible pollution to either fresh or saltwater bodies at the present time.

5. Barnstable

There is only one area in the Town of Barnstable that is polluted to the extent that the taking of shellfish is prohibited. That area is in Lewis Bay in Hyannis at a point starting at the Hyannis Steamship Line running to School Street and embracing that area lying north and northwest of that line. This is, of course, the most intensively used area in Lewis Bay with pleasure craft, fishing draggers and the steamships all converging on this one point. The State did not specifically classify this body of water.

Contrary to some public sentiment, there is no measurable pollution in the Barnstable Harbor marshes attributable to the Barnstable County Sewage Disposal system at the present time. There is a regular surveillance program conducted by the County Board of Health on this facility including chlorination to preclude any contaminants affecting shellfish in the nearby creeks.

6. Yarmouth

There is no discernible pollution in any of the fresh or saltwater bodies of Yarmouth including Lewis Bay and Bass River. Both of these latter two major bodies of water are subjected to adequate tidal action to preclude, at least, at present levels of usage, measurable pollution.

7. Dennis

There is no evidence of any fresh or saltwater pollution at the present time in the Town of Dennis.

8. Brewster

There is no evidence of any fresh or saltwater pollution at the present time in Brewster.

9. Harwich

Until just recently, the Herring River has been polluted and closed to shellfishing. This pollution, for a number of years was attributable to the Town Disposal Area located at the edge of Herring River Marshes.

However, several years ago, a dike was constructed around the perimeter of the Disposal Area in an attempt to minimize the leaching of contaminants into the River. According to tests conducted by the County Board of Health this summer, all pollution has been abated in the River and it could probably be reopened for shellfishing.

The Disposal Area is about to be relocated in the near future anyhow and thus this major source of pollution will be eliminated.

No recent tests have been conducted in Wychmere Harbor so that the degree of pollution, which may or may not exist in this busy harbor, is unknown at the present time.

10. Chatham

The only pollution that existed here until just recently was Frostfish Creek by the Acme Laundry in Chathamport. For some time the Board of Health had felt that there was an apparent pollution problem due to seepage from the sewerage facilities of the Acme Laundry. But a recent inspection by the County Board of Health resulted in a finding of no pollution attributable to the laundry. However, there has developed some pollution attributable to a flock of ducks habitating in the immediate vicinity of the headwaters of the creek. And, apparently, it is sufficiently high to preclude the reopening of the area to shellfishing. At the present time there are no other problems and while Stage Harbor is witnessing increased boating activity each year, the Board of Health conducts a relatively close surveillance program.

11. Orleans

With a possible exception; there is no evidence of any fresh or saltwater pollution in Orleans. There is one location that the Town decided to close to shellfishing in the vicinity of the Nauset Marshes immediately south of Mayo's Duck Farm. The Town felt that in periods of heavy stormwater runoff, contaminants may be carried into the marsh from the farm's storm drainage system.

12. Eastham

There is no fresh or saltwater pollution in the Town of Eastham, and no areas are closed to shellfishing.

13. Wellfleet

There is no fresh or saltwater pollution in Wellfleet, and no areas are closed to shellfishing.

14. Truro

There is no fresh or saltwater pollution in Truro and no areas are closed to shellfishing. There is, however, a problem which more properly could be defined as air pollution. The following remarks describing the problem are extracted verbatim from a letter written by a Irving Gernt, member of the Truro Planning Board and a cottage colony owner on Beach Point to the Selectmen of Truro. Mr. Gernt also testified on the matter at the April 14, 1967 hearing on Water Quality Standards.

"I don't know if you are familiar with our problem, which is pollution in the bay and is considered a public health hazard by the Army Corps of Engineers. They stated that there are large masses (approximately 2000 cubic yards in volume) of decaying seaweed deposited along a 1½ mile ------

"section known as Pilgrim Beach, in the Provincetown-Truro area. These deposits have been carried into their area by longshore currents and wave action. During the lower stages of the tides, the masses of decaying seaweed is exposed to the air and sun, causing an extremely fowl and sickening odor of hydrogen, sulfide gas.

"These fumes have caused houses to discolor, tourists and guests have complained of headaches, eyes burning and small children (ages 1 to 3) have broken out over their entire bodies with red pimples after being in the water for different periods of time, within two days.

"The selectmen and residents of this town and Provincetown have been to several meetings, in the past, with different state officials, everyone realizes we have a serious problem, but it seems, no one can help us.

"At a November 1966 meeting, we were led to believe that matching funds would be available from the Department of Waterways to do a temporary job on the sandbar, that is causing our problem. Therefore, in good faith, an article was placed on our warrant to raise $3,500 to dredge channels thru said sandbar and eliminate the public health hazard. Provincetown did the same thing. These funds were approved at our town meetings.

"Now we are told that the Division of Waterways have no funds, so now we are right back to where we started.

"This state is spending thousands of dollars advertising to out of state people to vacation in our state and if and when they do come to the lower Cape, many turn and go back very disappointed, due to the fowl odor.

"We feel, if nothing is done to eliminate this situation, word will get around by word of mouth and everyone will be hurt, the business people, the town and the State by loss of taxes."

15. Provincetown

At the present time, the area between McMillan Wharf west to the Atlantic Coast Fisheries Corporation building and Wharf is closed to shellfishing by the State Department of Health. While pollution is partially attributable to the intensive boating activity, both recreational and commercial, in the area, one of the primary sources is the fish processing operation conducted by Atlantic Coast Fisheries. Apparently, the residue of the fish processing operation is piped directly into the harbor and serious pollution results. This is the only instance of industrial pollution uncovered in any of the Cape communities.

B. Implications and Conclusions

1. Fresh Water Streams

No evidence of fresh water streams pollution on Cape Cod has been uncovered in this survey. The Water Resources Commission has adopted a Water Quality Standard of B for all such streams on the Cape. It should be noted, however, that this is the highest standard assigned to all freshwater streams in the State except those designated for use as public water supplies in accordance with Chapter 111 of the General Laws. Waters used for such public water supply purposes have been designated A.

Only one natural body of freshwater on Cape Cod is used for public water supply purposes--Long Pond in Falmouth.

Class B water is suitable for bathing and recreational purposes including water contact sports. It is suitable for agricultural, and certain industrial cooling and process uses; excellent fish and wildlife habital and excellent esthetic value. To be acceptable for public water supply purposes, however, appropriate treatment would be required.

For all practical purposes, the class B designation of the Cape's fresh water streams appears compatible with any prospective uses such streams might be used for. However, the standard of A should most assuredly be assigned Long Pond in Falmouth.

2. Coastal (Saltwater) and Marine Waters

There are four Towns on Cape Cod which are witnessing measurable pollution; Sandwich, Falmouth, Barnstable and Provincetown. Although the Water Resources Commission, through its designation of the Cape Cod Canal as SB, implied some degree of pollution, the Barnstable County Board of Health is of the opinion that such pollution is not of a degree to warrant a prevailing standard of less than SA.

In the case of Sandwich, the Town is presently preparing preliminary plans for the eventual construction of a sewerage system. It might safely be assumed that the first phase of such a system will attempt to eliminate present pollution problem in the Old Harbor Creek area. this the State's proposed upgrading of the present SB standard in the area to SA is already being implicated by the Town.

With respect to Falmouth, the County Board of Health is of the opinion that Eel Pond in Woods Hole can be immediately reclassified to SA. In Little Harbor, also classified SB, it is understood that the Coast Guard is planning to install new sanitary facilities on shore to receive the sewerage from the vessels when they are in port. This will further improve the pollution situation in Falmouth.

Falmouth Inner Harbor is presently classified SC and the State has proposed its upgrading to SB. This Harbor is unquestionably one of the two busiest harbors on Cape Cod--the Hyannis section of Lewis Bay being the other one. And falling in line, in terms of boating activity is Wychmere Harbor and Allen Harbor in Harwich, Stage Harbor in Chatham and Provincetown Harbor. And with the exception of Provincetown Harbor (whose pollution problem is aggravated by industrial pollution) they presently or will in the not too distant future, share a common problem--pollution attributable to watercraft. And to pose the question in the context of the State's Water Quality Standards--is a standard of SA obtainable in the harbors under present Federal, State and Town laws?; and can such a standard be maintained under more intensive watercraft usage of the harbors?

All of these harbors suffer from varying degrees of gas and oil pollution from watercraft. They all probably suffer from varying degrees of pollution attributable to sewage disposal and refuse disposal from the watercraft. All of the affected Towns have various types of health regulations aimed at controlling and regulating the degree of pollution ranging from a restriction in the Town of Chatham-prohibited any overnight residency on watercraft to universal prohibition in all of the Towns of the flushing of heads while the craft are in the harbor.

The Town of Barnstable and Falmouth provide public rest facilities adjacent to the harbor facilities as a convenience to the boat-owners. The Towns of Harwich, Chatham and Provincetown rely on the provision of facilities by private marina operations. This is a totally inadequate situation and should be remedied by the respective Towns in the near future.

The possibility of sealing the heads on watercraft when in the harbors has been reflected upon by several of the Towns' selectmen but this is generally considered unworkable. Many of the watercraft are transient and/or used for charter or sportfishing on a daily basis. This practice would place a heavy manpower burden on the Town's Harbormasters for a short period of the year.

The Appendix contains several enclosures which describes the interest on the part of several groups, including the State of Federal regulations dealing with the mandatory installation of chemical toilets and/or chlorination devices on all watercraft of a certain size at the factory. The enclosure entitled, Watercraft Waste Disposal does indicate that the State will probably adopt rules and regulations relative to the discharge of sewage waste water from watercraft within five years.

To further complicate the picture, of the two major types of pollution generated by watercraft--gas and oil residues and sewage waste water--it is the opinion of the Barnstable County Board of Health that the gas and oil residues represent the more serious contaminants to shellfishing, and this is the one type of pollution that would seemingly defy control.

In summary, each of these major boating harbors is a unique situation to be sure. While, for the immediate future, the standard of SA may well be applicable and, indeed, appropriate, for the harbors in Provincetown, Chatham and Harwich, the intensive activity, at least, during the summer months, in part of Lewis Bay in Hyannis and the Inner Harbor in Falmouth may preclude the attainment of such a standard. Regardless of the standard to be applied to the harbors, however, the aforementioned Towns because of their inviting harbors will witness ever-increasing boating activity, which in turn will produce increased pollution.

With proper enforcement procedure and the provision of adequate supporting on-shore facilities, the pollution from watercraft can probably be controlled to the extent that full recreational usage and enjoyment of the water can be realized by all concerned and the attractive Cape environment will remain unimpaired. But one aspect of the pollution problem poses a more enduring challenge--the effect of this pollution, especially gas and oil residues on shellfish.

The point at which boating activity begins to necessitate depuration of the shellfish (usually by transplanting) is an undeterminate. And even if depuration becomes necessary in a particular harbor (as it already has in Falmouth) will the economic benefits of the increasing boating activities to the Town offset the additional shellfish transplanting costs to the Town? It will be the responsibility of the towns together with the Cape Cod Planning and Economic Development Commission to develop the answers to these questions and jointly meet the challenge of water pollution in the Cape Community.

WATERCRAFT WASTE DISPOSAL
(Extracted from Vol. 1, Water Quality Standards-Laws, Policies & Standards)
(June 20, 1967)

The Commonwealth of Massachusetts has taken cognizance of the problems of the control of the discharge of wastes from pleasure watercraft and vessels, and considers the problem one of significance and one deserving of early definitions and corrective action. The Commonwealth believes that some means of watercraft waste treatment and/or control must be developed which will either effectively eliminate the discharge of waste (no effluent device) or which will adequately treat the waste so as to render it acceptable for discharge to the surrounding waters (controlled-effluent device). The acceptability of such devices must depend not only on the equipment itself, but also on the availability of maintenance and repair and replacement service. The Commonwealth further believes that because the watercraft cruise in waters of adjacent states there should be uniform interstate requirements and regulations.

In 1966 the Commonwealth was a conferee at the National Conference on Watercraft Waste Disposal conducted by the National Sanitation Foundation with the assistance of the U. S. Public Health Service and the Tennessee Valley Authority. The conference was convened as a result of resolutions adopted by Water Pollution Control and Public Health Agencies calling for leadership in the development of test programs for sewage and waste treatment devices for pleasurecraft, and cooperation in the development of an acceptance program for these devices through a national testing and an evaluation laboratory. The resolutions also urged the U. S. Public Health Service to expedite the issuance of the policy governing disposal of sewage and waste from vessels involved in interstate operations.

It was the conclusion of the conference that because of the interstate cruising of the watercrafts there should be uniform regulations and uniformity of acceptance of treatment devices throughout the U. S. It was also concluded that the states should establish a public health education program regarding the control of waste disposal from watercraft.

It was formally recommended that the National Sanitation Foundation be adopted as the mechanism through which criteria for waste treatment holding and disposal devices for watercraft should be pursued.

The Commonwealth does not intend to adopt rules and regulations at this time, pending the development of suitable devices. It is preparing a resolution to be presented at the next meeting of the New England Interstate Water Pollution Control Commission, calling for study and joint action by the compact states in this matter. The Commonwealth further tends to pursue a program of educating the local officials as to their responsibility in providing dockside devices or receptacles to receive the waste from pleasure crafts. It is estimated that within five years suitable control devices will have been developed and that the Commonwealth will have adopted rules and regulations relative to the discharge of sewage waste water from watercraft.

The Division of Water Pollution Control, under existing laws has no control over the construction or operation of marinas. At the present time the Division plans to control the pollution from boats using the docking facilities by means of watercraft rules and regulations.

IMPACT OF POLLUTION ON OUR COASTAL WATERS

Aesthetic Value of Estuaries

The aesthetic value of an estuary gives the individual much that he desires, for Nature's beauty is collected in man's thoughts along with the aesthetic charm of a community bordering an estuary. All these values cannot be measured in dollars and cents.

Personal Value of Estuaries

Personal values are also effective because an estuary receives irreplaceable nutrients from its tidal marsh, which in turn are essential to support plant and animal life. Different species benefit man and other animal life with their food supply. This same estuary serves as an incubator and nursery ground. It also has the same potential of collecting pollution.

Recreational Value of Estuaries

The recreational values of an estuary are enjoyed by many families who love to shellfish, swim, fish, and go boating. Families who have purchased high-priced land along our estuaries enjoy these privileges plus all of their aesthetic values as well.

Dollar Value of Estuaries

As an example of the dollar value of an estuary, I have prepared the following breakdown of estimated production and their respective values for 1966 for the shellfish harvested from the waters of Waquoit Bay in the Town of Falmouth.

soft shell clams	643 bushels	$7,716.00
scallops	2,877 bushels	$21,577.50
quahaugs	4,513 bushels	$45,130.00

Damage By Pollution

The following is a list of the areas closed to the taking of shellfish due to pollution:

Little Harbor, Woods Hole	38 acres
Eel Pond, Woods Hole	16 acres
Falmouth Harbor	40 acres
Section of Great Harbor, Woods Hole	acres unknown

The Town of Falmouth spends $5,500 annually in transplanting quahaugs from these contaminated waters into clean waters and utilizes them in this manner.

Pollution is costly and cuts down on the efficiency of our town. Eel Pond, Woods Hole, and Little Harbor, Woods Hole, are very important areas to the Shellfish Department because our local shellfishmen could be shellfishing these areas during the winter months if these areas were free of pollution. It would also keep the shellfish industry alive and many families clothed and fed with the revenue received from the industry. What stops all this from coming true? FILTH!

Pollution is a serious health menace. State Public Health has proven this by closing the previously mentioned four large areas to the taking of shellfish.

Pollution destroys beauty by bringing filth into our beautiful recreational boating harbors.

Pollution knows no boundaries. It pays no respect to people's property and it raises our taxes in trying to correct the pollution problem. It should not be there to begin with! Our first experience with pollution began in the late 1920's due to raw sewage being discharged from the homes and boats into Eel Pond, Woods Hole, knowing no boundaries, it spread into Falmouth Harbor in the early 1940's. As bad luck would have it, it appeared in Little Harbor, Woods Hole, in the early 1950's. Under investigation by State Public Health and myself we found our own town sewage system contaminating a section of Great Harbor, Woods Hole; result, a section of Great Harbor, Woods Hole, closed to the taking of shellfish in late 1966. Our shellfish beds are now being threatened by so-called "Progress", due to the fact that land developers feel it necessary to have a Marina in order to bring high prices for their land. All this is good, but not at the expense of the shellfisheries. Experience has taught me that this type of progress leads to another closed area in the future.

Future of Coastal Zones

Our coastal zones should be preserved in their natural state. Man should assist Nature when Nature has failed us. Keeping our channels open along our coastal lines leading into our estuaries is an important part. A good channel takes away some of the hazards of navigation and its water current provides good circulation bringing in food with each change of tide. The current also works as a sanitary agent carrying away products of decomposition and waste, thus preventing contamination.

Best Uses of Estuaries

1. Source of supply for food.
2. Facility for boating and navigation.
3. Recreation Grounds.
4. Aesthetic Value.

System of Management

Local, State, and Federal Agencies must cooperate in their fullest capacities to improve the quality of our waters. The Federal people should pave the way first of all by cleaning itself up. The machinery for prosecution of offenders has been established. Polluters are subject to fines of $100 per day for unlawful discharge of wastes.

A meeting of the minds of all agencies concerned with clean water is of the utmost importance. Small towns bordering our coastal waters must be made to understand the hazards of pollution. Monies should be made available to correct these problems along with good common sense.

Above all, present laws from all agencies concerning pollution of our waters should be reviewed, made known to the general public, and ENFORCED!

Respectfully submitted

/s/ George Souza

George Souza
Shellfish Warden
Town of Falmouth

Notes on Some Applications of Remote Sensor Technology To Pollution Detection and Control

(Expansion of statement to the Public Meeting on Impact of
Pollution on our Coastal Waters, held in Boston
on October 8, 1968)

by

A.C. Conrod

MIT Experimental Astronomy Laboratory

Recent studies in aerial and satellite photography and radiometry has resulted in the development of techniques which can be applied to the problems of detection and identification of pollution of water and air. This note will explain some of the methods that are available now, and possible applications.

Most of the work in this field has been government-funded research, sponsored by the Departments of Defense, HEW and Interior, and by NASA. Our laboratories work has been funded by NASA and administered through the U.S. Naval Oceanographic Office's Spacecraft Oceanography Project, for NASA's Earth Resources Survey Program. The term "Remote Sensing" used in the title of this note, refers to the whole range of instruments; cameras, heat sensors, radar and spectrometers; and to the use of one or more of the instruments in a survey of an area for mapping, inventories and resources, or monitoring of environments.

The methods of airborne surveillance that will be of principal interest to the worker in pollution are photography and thermal infra-red radiometry and imagery. Since most pollution investigations are concerned with limited geographic areas, only aircraft methods will be mentioned here. The reader will probably visualize how these techniques, when applied from satellites, could be expanded to cover larger areas; entire river basins, coastwise ocean current systems, or large bays and gulfs.

The systematic use of aerial photography for resources management goes back to the 1930's, when the geologist, forester, highway engineer and agronomist realized the potentials of aerial coverage for mapping and exploring. Today, few people in these disciplines would even consider beginning a project without first obtaining recent aerial photogrpahy of the site. Until relatively recently, all aerial work was done in black & white only, limiting its application in some biological and hydrological surveys. With the increasingly widespread use of color films, the scope of applications of aerial photography has broadened, so that today it is possible to make identifications that were very difficult, if not impossible, on black and white photography by the average user. While it is true that older, highly skilled photo interpreters prefer to work with black and white film only, and some use only the negatives, the average scientist and engineer, with neither the time or inclination to learn all aspects of the art of photointerpretation, is much better served by color materials.

Aerial color films are available in positive (transparency) materials, such as Ektachrome and Anscochrome, in negative materials (for paper positive prints) such as Kodacolor, and also in "false color" or "camouflage detection" film, which records images in the green, red and near infra-red spectrum. This last is a Kodak product, Ektachrome Infra-red Aero. The illustrations following show some representative coverage obtained with the films mentioned.

The first illustration is a black-and-whte photograph of the south coast of Cape Anne, Massachusetts. The most prominent features in the scene are the foam slicks along the shore. (This and the following photographs were taken in the late spring, so that these were probably naturally-induced slicks, rather than from artificial sources.) Figure 2 is a color photograph of the same phenomenon, at a point on the coast within a few miles of the first scene. Both photographs show the water to be quite opaque, possibly due to plankton patches that may have been associated with the slicks. Figure 2.

Figure 3 and 4 are color aerial obliques of Manchester, Massachusetts, harbor and of one of Cape Anne's cleaner tidal estuaries, respectively. The greenish coloration in the foreground is probably not associated with the harbor cove slick, more likely it is from naturally occuring floating material. (The angle of this photograph is too high to show significant depth penetration.) Figure 4 shows a relatively undisturbed coastal wetland. This photo also shows some depth penetration; we can see submarine rocks in the lower left, and the sand bar between the small island and the shore that is built up by wave refraction around the island. The estuary's outflow plain can be clearly seen. These photographs were all taken with hand-held cameras from light aircraft, and are typical of the kind of photography that can be obtained with amateur-type cameras from an airplane that can be rented for a nominal sum (i.e., less than $20.00/hour, including the pilot). They are also typical of the kind of photography that could be used for an investigation of a small area, or a single site.

Large area, systematic coverage will require a large aircraft with aeral cameras. Similarly, thermal infra red imagery is usually synonymous with large, expensive aircraft. Such services are available from the instrumented NASA planes, and may in time be made available from similar airplanes that other government agencies may be using in their various programs.

The following illustrations were based on photography from a NASA airplane, using an aerial camera. Figure 5 is a photograph of a portion of the West edge of the Bahama Banks, which was taken from an altitude of 25,000 feet. The illustration is many generations removed from the original transparency; nevertheless a considerable amount of detail is still visible in this print. The photograph can be used directly for vegetation mapping, and for drawing inferences about currents, tides and water depth from the distribution of vegetation and the locations of sand dunes and channels. Figure 6 shows a mechanically-produced "false color" rendition of the original photograph. This illustration is the result of having analyzed the original image to determine areas of similar color and density, so an automatically-prepared map of the features of the site could be prepared. Field surveys have verified the accuracy of this technique, which is one of several methods of automatic map annotation being studied today. The principal value of aerial photography in large area surveys is in telling the investigator where he should concentrate his ground survey activities, since we are at present rather far away from being able to do speciation from the air, or to determining without ambiguity the environmental conditions that exist at a site, even with the aid of automatic mappers. Nevertheless, the user can save an enormous amount of time and effort by doing a preliminary survey from the air, so that he can ration his time most efficiently in his site survey work. Properly applied aerial surveying can at least halve the time that must be spent in the field.

The other photographic film mentioned above, color infra-red film, is sensitive to light in the near infra-red band as well as to visible light. The principal application of this film in pollution studies is that it shows live vegetation, including algae, as a vivid red due to the high infra-red reflectivity of chlorophyll. The film can also indicate the degree of plant vigor, aids in defining boundaries between differen species of plant growths, and can show plants whose natural color or low visual contrast might make them difficult to detect by normal photography, or by eye. Figures 7 and 8 show two scenes of the Massachusetts coast near Duxbury, including part of the North River estuary. The photographs were taken at low tide, so that the inter-tidal zone vegetation is clearly seen on the two groins. The water content of sand below the high-water mark, and the density and variety of plant life in the wetlands (especially in Fig. 7) can be estimated better on these photographs than would be the case with normal color film. It should be noted that these photographs were made with a hand-held 35 mm camera. The film is available in all sizes, from 20 exposure, 35 mm rolls to 9 1/2" wide aerial film.

So far, we have spoken only about photographic images. Images in the thermal infra-red can also be produced, given the appropriate equipment, so that we can literally draw a picture of the surface temperatures at a test site. This is done by sensing the thermal radiation (usually in the 8-14 micron band) and converting the signals into visible light so that a black and white "photograph", sometimes called a thermograph, of the target is produced. Such an image is shown in Figure 9, a power plant site at Turkey Point in Miami's Biscayne Bay. This particular power plant complex is being investigated now by the FWPCA , and evidence of conditions at the site is being gathered from the airborne coverage obtained for our Laboratory by NASA aircraft, including this thermograph and others like it. The light tones indicate high temperatures, and one can clearly see the heated water issuing from the plant's cooling water outlet canal. Such "thermal pollution" can be as important to the marine ecologist as a surplus of nutrients or the presence of industrial wastes.

Thermal imagers are useful in charting current distributions and land runoffs, as well as in detecting and measuring waste discharge, since they are sufficiently sensitive to detect the slight temperature differences that usually exist between near-shore waters and cooler water masses off shore, or between coastal waters and land run-off. The thermographs can be calibrated,with given shades of gray signifying known temperatures.

The preceeding comments have been of a cursory, non-technical nature, but may help to show some of the techniques and services that are available today. Planning for environmental surveying should take this technology into account, and the workers should try to make maximum use of airborne and spacecraft cameras and instruments to assist them in their studies. We can reasonably expect that more instrumented survey aircraft will be built and equipped in the coming years so that coverage will become more generally available. Satellite systems for Earth resources surveying will be operational by the early 1970's. In the meantime, good use can and should be made of small planes and simple cameras, as mentioned in this paper.

A short selected bibliography is provided for further reading in this area.

Selected Bibliography

"Manual of Color Aerial Photography" Smith, J.T., Editor American Society of Photogrammetry Falls Church, Va., 1968.

"Aerial Discovery Manual" Strandberg, C.H., John Wiley & Sons, New York, 1967.

Conrod, A.C., M. Kelly & A. Boersma "Aerial Photography for Shallow Water Studies on the West Edge of the Bahama Banks" MIT- Experimental Astronomy Laboratory, Report No. RE-42, November, 1968.

Wiesnet, D.R. and J.E. Cotton " Use of Infra-Red Imagery in Circulation Studies of the Merrimack River Estuary, Massachusetts" Tech. Ltr. NASA-78, U.S. Geological Survey Interagency Report, October, 1967.

"Photography from Small Aircraft and Helicopters" Pamphlet No. M-5, Eastman Kodak Co. , Rochester, N.Y., 1966.

COMMENTS FOR THE RECORD

by

Dr. B. M. Fabuss
Technical Director
Environmental Pollution Division
Lowell Technological Institute Research Foundation

The pollution of coastal waters and rivers can hardly be separately handled. Indiscriminate dumping can be fought only by building of treatment facilities. As a result the capital expenditure for waste treatment should probably be $20 to $30 billion in the next five years. Even these expenditures would not result in substantial reductions of pollution but would merely maintain present pollution levels. Due to these facts of life, we must rely on the self-purification capacity of rivers and coastal waters to an increasing level. The self-purification capacity of river streams can be significantly increased by proper management of river streams, utilizing to its limits the diurnal variation of dissolved oxygen and pollution discharge loads. As long as river water self-purification problems are handled with kinetic expressions derived in the early 1930's, which give only vague and approximate results, no comprehensive work has been made on self-purification of estuaries and coastal waters.

It is recognized that this problem is much more complex, complicated by tidal and salinity effects, but a concentrated effort should yield valuable results.

Our preliminary measurements and calculations on the Merrimack River indicate that pollution levels can be decreased by about 30 percent by proper management of discharge. The same should apply to estuaries and coastal waters. This reduction of pollution can be achieved with a minimum of cost compared to the cost of treatment facilities.

October 7, 1968

A STATEMENT BY DR. WILLIAM VINAL, NATURAL RESOURCES CONSULTANT FOR THE MASSASOIT COMMUNITY COLLEGE, NORTH ABINGTON, MASSACHUSETTS ON THE SUBJECT OF "ESTUARINE POLLUTION".

We are grateful for an opportunity to respond to Mr. Klashman's invitation of September 20, 1968 on the above subject.

While we are all concerned with serious problem of water pollution in Massachusetts, our statement at this time will be confined to what we believe is perhaps a typical problem. THE NORTH RIVER WATERWAY in Southeastern Massachusetts is in the process of deterioration and pollution as are many other similiar waterways in the Commonwealth at this time. We believe we can best serve the purpose of this study by confining our remarks to the NORTH RIVER WATERWAY.

The question is asked, "What are the values of an estuary?" My response is:

THE VALUE OF THE NORTH RIVER ESTUARY IN DOLLARS AND CENTS IN 1965:

Soft Shelled Clam Harvested	$	15,468.00
Blue Mussels		8,025.00
Lobsters off the mouth (Six lobstermen anchored their boat in the river in 1964.		12,370.00
Sport Fishing in the Area (Winter Flounder, Cod, Pollock, Mackerel, Haddock, Bass)		70,000.00 (Est.)
Live Bait sold commercially		10,800.00 (Est.)
Two Boat Liveries, "Mary's and Lou" A large fleet of about 75 dories		
Two Marinas, valuation of boats served		Several Million (Est)
Pleasure boating, swimming, camping, picknicking, Summer cottage rentals		One Million (Est)

The Town of Marshfield has areas for commercial digging of clams and family digging. As far as I am concerned, "digging clams" is a sport and the value cannot be estimated, especially when digging with one's son!

The value of land along the North River has suddenly escalated far beyond the value of inland surrounding areas. Farms that were recently valued at $ 2,000. to $4,000. a few years ago are now selling at $ 8,000. to $10,000. per acre houselot. Let me cite the case of the so-called "Barque Hill Development".

As a HISTORICAL RESOURCE we can safely point to the NORTH RIVER WATERWAY as one of the most unsung, underated areas of outstanding historic significance on the eastern coast of the United States. I stress the following facts: Over 1,000 vessels were built in the Shipyards on the banks of the North River during the period of the infancy of the United States of America. At one time it was one of the leading ship-building headquarters in the country. Let me remind everyone that the first vessel to carry the American flag around the world was built on the North River! In addition, let me mention that Ship "Beaver" which took part in the Boston Tea Party as well as the "Columbia" which discovered the Columbia River in Oregon were both constructed on the North River.

The "Elbow" above Union Bridge harbored a garrison in King Phillip's War and today remains a site unexcelled for its beauty.

The Three Herring Brooks were noted for the spawning of shad and alewives. There were strict colonial laws against impeding their migration by the building of dams. We now find a number of brooks in the region named "Herring Brook". The fact is that we now approach a time where we will have more "Herring Brooks" than there are herring! The industry has disappeared for a variety of reasons. In fact it has virtually dissappeared except at the "Herring Run" at Pembroke which attacts hundreds of curious motorists in season who no doubt purchase much gasoline, etc., etc.

THE POLLUTION OF SALT WATER LOCALLY:

The North River is pronounced clean by the Massachusetts State Board of Health. Nearby harbors at Scituate, Cohasset and Hingham, are polluted. Swimming is prohibited in many locations because of colon bacilli. Digging clams for family use is prohibited in many locations. Commercial diggers ship clams to Newburyport to be chlorinated.

Two communities (Scituate and Rockland) voted $2.5 million each in 1963 to dump sewage effluent, including poisonous chemicals, street salts and detergents into the clean North River because of the delusion that it was the "cheapest way out". Scituate was finally persuaded to build a filter plant, although I question the size of the leaching bed for the exploding population in that community.

Rockland has indicated intent to dump effluent into French Creek, which goes dry in some drought periods. This community has had its difficulties in planning and zoning. It is significant perhaps that it is often troubled with floodedcellars in some neighborhoods.

I want to express tribute to the Hub Chapter to the Izaak Walton League which played an important role during the 1963 efforts to dump effluent into the North River. The League did an excellent job in calling attention to the problem and assisting in marshalling public opinion in favor of controls.

Unfortunately there is still continued direct dumping of raw sewerage by homes along the banks of the North River and in many, many instances of boats using the river. This estuary is about 20 miles in length (Tidal part) and is incapable of digesting the present volume to say nothing of the population doubling in the next few years.

THE FUTURE OF THE NORTH RIVER:

The future is dependent upon proper Management and that in turn is dependent upon EDUCATION. It may not seem necessary to add that the education of local citizens in any community and the arousing of interest, to say nothing of the marshalling of knowledge and experience is sometimes a discouragingly slow process as I can attest after some 60 years working in the field.

The need for scientifically-trained personnel becomes more obvious as the years go by. The futility of one town's efforts in the passage of forward looking by-laws and ordinances for conservation and related fields being cancelled out by the neighboring community's apparent ignorance or disregard of the needs of adequate laws is repeated more times than is necessary. One can safely say that the problem of REGIONAL WATER SUPPLY is a matter to be treated on the highest priority as it affects the area traversed by the NORTH RIVER WATERWAY.

One wonders if it is possible, and economically safe, to build a major resevoir on the North River above the tidal part? Certainly it is not too soon to initiate planning in this direction.

The authorities responsible for our water supply must make it clear to all citizens that ground water is public water and that swamps, ducks, clams, wild life, and estuaries are owned by all the citizens! We see in this area dumps which have been condemned; use of water restricted; the building of super-highways by the Commonwealth through land sold by the Federal Government at half price which was supposed to used as a "wilderness"; developers thrusting 40 to 50 cessppols on an area without reserving any land or water for recreation. All of these abuses may be found on the borders of the North River Waterway.

Towns on the South Shore of Massachusetts are noted for their independence rather than acting for the mutual benefit. In fact it may be noted that in some towns Selectmen even fight amongst themselves. One suspects that some individuals become members of the Conservation Commission for the glamour. Normally it takes about three years to realize what it is all about and then they resign. Rip Van Winkle should wake, but there is no sign that he will. Healthy outdoor recreation is not simply bought with money. Non-political REGIONAL PLANNING is the answer.

AN ANNUAL REGIONAL REPORT:

One of the most effective ways I can suggest of marshalling the public interest and widespread cooperation of communities bordering the North River Waterway would be to provide for an annual Regional Report similiar to the Town Report so familiar to communities in the area. The writer has kept clipping books of North River problems for many years. An Annual Regional Report widely distributed in the area would help immeasurably in dramatizing the disaster, and consequently aiding in the marshalling of public support in stopping the forces of destruction of the estuary.

From my own files I would be glad to make available the volumes of clippings, photos, slides in a comprehensive report which could supplement my own report "The North River Country". Although there are many like myself who are dedicated to the preservation of the North River and all of the "North Rivers" in this nation we cannot keep up its defense forever. We know that we cannot turn back the clock, but we can recognize an alarm when it is ringing, and believe me the alarm is ringing now!

SUMMARY:

It is my firm belief that an institution such as the Massasoit Community College should be capable of implementing social studies, marine biology, forums on local government and the advancement of regional thinking. This educational institution adjacent to the North River area should play an important role in focusing community concern for the pollution of the estuary involved. Other educational organizations should provide similiar leadership elsewhere. Unless the leadership in this country does otherwise one can predict certain disaster for the estuaries of this nation which flow through highly populated areas.

October 1968

John S. Farlow, Regional Co-ordinator
National Estuarine Pollution Study
North Atlantic Water Quality Management Center
Edison, New Jersey 08817

Dear Mr. Farlow:

We, the residents of Seconset Island, are terribly concerned about the diking which is taking place as a result of a new road being placed across the causeway.

The causeway separates Hamlin's Pond overflow from Waquoit Bay. We understood, when this road was proposed, that they were going to put culverts under the road between Waquoit Bay and the waters from the marsh from Hamlin's Pond to allow an ebb and flow of the tide and complete circulation of the water.

This road is being constructed without culverts, and we believe that unless culverts are put in this will cause an increasing amount of stagnation in this area.

We believe the road should be constructed as originally planned with culverts, and if this was done, it would improve the quality and purity of the water both in the Hamlin's Pond overflow area and Waquoit Bay.

We think this is an extremely important matter because of the grave consequences of pollution that this road that is presently being constructed may cause and because of the large amount of scallops, quahogs and other shell fish which are taken from Waquoit Bay, this pollution might cause them to be unfit for human consumption.

We earnestly solicit your interest in this matter.

[illegible] Oneal
Clifford Lindberg Jr.
[illegible] Lindberg
[illegible] Kater
James E. Davis

James F. David
Gerald [illegible] Sprout
Jacques André [illegible]
E. Brooks Becker
[illegible] F. Conroy

The Standard-Times

Serving Southeastern Massachusetts for more than a Century

New Bedford, Massachusetts 02742

September 10, 1968

Mr. Lester M. Klashman
Regional Director
U. S. Department of the Interior
Federal Water Pollution Control Administration
Northeast Region
John F. Kennedy Federal Building
Boston, Massachusetts 02203

Dear Mr. Klashman:

Thank you for your invitation to the public hearing on pollution of coastal and estuarine waters October 8 at 9:30 a.m. at the Charter Room of the New England Life Building in Boston.

I enclose a file of clippings of stories and pictures which we have run about the problems of coastal and estuarine water pollution in the New Bedford and Southeastern Massachusetts area.

Certainly we are no experts in the matter; we are reporting the thoughts and worries of people who are concerned and knowledgeable about pollution of our water resources.

Our conservation, and outdoor writer, Ted Vincent plans to attend the hearing October 8, so that we can have a good report of the views which are presented.

Please accept as my contribution to this hearing the enclosed clippings from the New Bedford Standard-Times.

Sincerely,

Jim Ottaway Jr.

James H. Ottaway, Jr.
Publisher

p

encl.

Water Pollution -- I

Better Resource Use Advocated

(This is the first of a series of articles concerning water resources problems of the state assessed in terms of future development of Greater New Bedford).

By TED VINCENT
Standard-Times Outdoors Editor

Of all the reckless devastations of our natural heritage, none is more shameful than the continued poisoning of our rivers.

Pollution is a spoiler. It is ugly, costly and insidious. It closes beaches and prevents youngsters from wading, swimming, boating, water-skiing and fishing close to home.

It fills lakes, streams and estuaries with debris, scum, foam, oil, garbage and other loathsome wastes.

Cost Increases

It increases the cost of drinking water, but decreases the value of property. It contaminates shellfish, destroys game fish, poisons waterfowl and other wild creatures. It degrades the quality of our environment. In the future, the quality of our water resources can govern the duration of our lives.

The critical issue of the future is the demand for better management of this region's total water resources—water supply, as well as water use, treatment and reuse.

Bernard B. Berger, director of the Water Resources Research Center, University of Massachusetts, in outlining the major water resources problems in Massachusetts, said, "The water resources problems of our state do not differ essentially from those in other parts of northeastern United States.

"However, in certain cases factors based on traditional attitudes, perspectives, and practices provide a coloration that make these problems unique."

Problems Cited

Five such problems are considered to be of particular interest in terms of future development of the commonwealth, Berger noted:

1. Conservation and optimum use of lakes.
2. Optimum use of major streams flowing through a growing metropolitan area.
3. Improvement of methodology for planning independent watersheds.
4. Accelerating the cleansing action of estuaries.
5. Determination of the role of wetlands in the development of an area.

Each of these water resource problem areas is characterized by a complex of important questions relating to the physical, chemical, and biological sciences; economics, conflicting interests and water rights, social influences and institutional needs and planning methodology. Berger discusses these problem areas as follows:

Massachusetts is blessed by a large number of small lakes which represent a very significant resource in terms of recreation and municipal water supply.

Potential Unrealized

In Massachusetts alone, there are some 1,300 such lakes whose average area is approximately 100 acres. The full potential of these lakes is far from having been realized.

However, the trend of regional development points to the need for conserving this water resource and planning for its intelligent use. To do this, several important studies must be undertaken:

A system for categorization of Massachusetts lakes is essential to the development of a long-range plan for optimum use of this water resource.

This system could be based on many ecological characteristics including size, geological history, age, hydrology, depth. bottom and littoral features, current and future primary and secondary uses, adjacent land use plans, and other factors.

The question of multiple use of drinking water impoundments is becoming acute. Historically, municipalities of Massachusetts fortunate enough to have acquired the entire watershed which produces their drinking water have restricted other uses of their impoundments.

Protests Grow

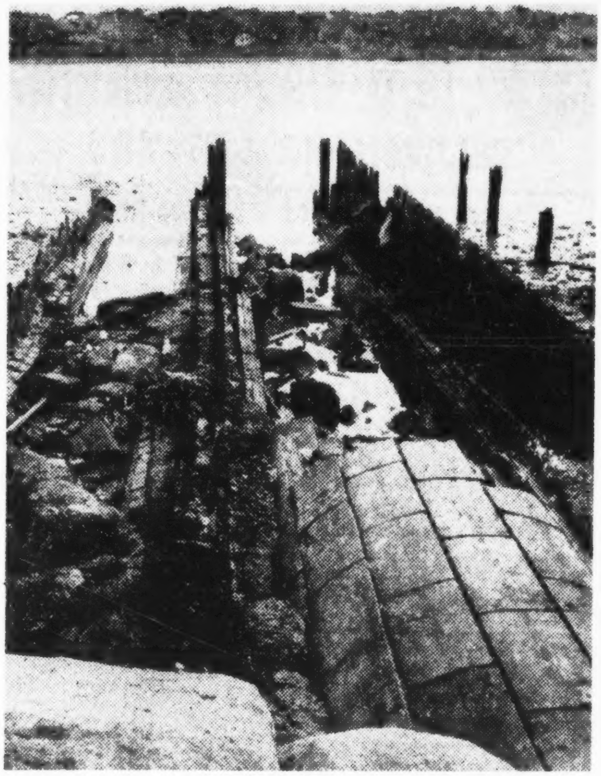
More and more, however, watershed associations and other groups are inclined to protest the elimination of recreational activities that is involved in preemption of a watershed for drinking water use only.

"Here we are beginning to experience a rather interesting conflict in water rights involving multiple use of drinking water reservoirs," Berger said "While the justification for restricting the use of such reservoirs is based on public health, unquestionably there is a very strong emotional factor that may well be overriding."

A subsidiary factor is reflected in the question, "Why should we permit our drinking water reservoir to be used by people who come not only from our city alone, but from places hundreds of miles away?" An objective approach to this problem is required, Berger says.

The process of lake aging must be arrested and reversed. The degradation of important lakes has gone quite far in some cases.

Fortunately, advanced aging does not characterize most of the smaller lakes in Massachusetts. Even so, one may see the handwriting on the wall. Unless checked, the process already going on will continue indefinitely as a result of man's activities.



—Standard-Times Staff Photo by E. Milton Silvia

WATER POLLUTION IS A SPOILER: Of all the reckless devestations of our natural resources, none is more shameful than the continued poisoning of our rivers. It cloeses beaches, contaminates shellfish and degrades the quality of our environment. A broken drain and clutter of debris pollute New Bedford's upper harbor.

Rate of Aging Jumps

Inevitably the rate of aging will increase as the recreational appeal of such bodies of water is exploited. Many of the small lakes have only very small outflow streams, or none at all, and consequently once aged, the lake may remain that way for prolonged periods.

The question of public versus private rights in respect to these bodies of water is only poorly defined, and it is quite certain that this problem will become increasingly acute. One may phrase this problem in terms of the rights of all members of the public to use the lakes for recreational purposes as against the rights inherent in riparian ownership or assumed by riparian proprietors, Berger says.

In theory, natural ponds of 10 acres or more in area belong to the public. In practice, accessibility of the public has been increasingly restricted as a result of private development on riparian land.

To what extent does development of a lake result in economic benefit to the region? In particular, how are adjacent land values affected by man's development of the lake resource?

Associated questions are: How important a factor in lake development is proximity to a growing metropolitan area? How does one determine the relationship between recreational appeal and distance from centers of population? What is the influence of a new highway in increasing the rate of development of a lake resource?

Other Questions

What institutional devices are most effective for maximizing the recreational benefits of a lake resource? Significant subsidiary questions are: "How do various water uses conflict — that is, fishing versus speedboating; and how can allocation among rights to such uses be optimally balanced?"

These are questions Berger has posed. They have not been answered.

(TOMORROW: Urban areas fail to take advantage of the benefits associated with adjacent major waterways).

Poisoned Water -- 2

Potential Often Wasted

(This is the second of a series of articles concerning water resources problems of the state assessed in terms of future development of Greater New Bedford).

By TED VINCENT
Standard-Times Staff Writer

Seldom do urban areas take full advantage of the benefits associated with adjacent major waterways, Bernard B. Berger, director of Water Resources Research Center, University of Massachusetts, said in reviewing the optimum use of a major stream flowing through a growing metropolitan district.

Only in respect to navigation, hydropower, industrial processing and cooling water, and waste carriage is such potential effectively exploited. Unfortunately, the practices normally employed impair the stream's usefulness in municipal water supply, recreation, fish and game propagation and agriculture. Further, only in recent years has the need for storage for flow augmentation to control water quality been studied carefully.

The same cannot yet be said for the integration of the underground flow of the stream into the total water resource management scheme.

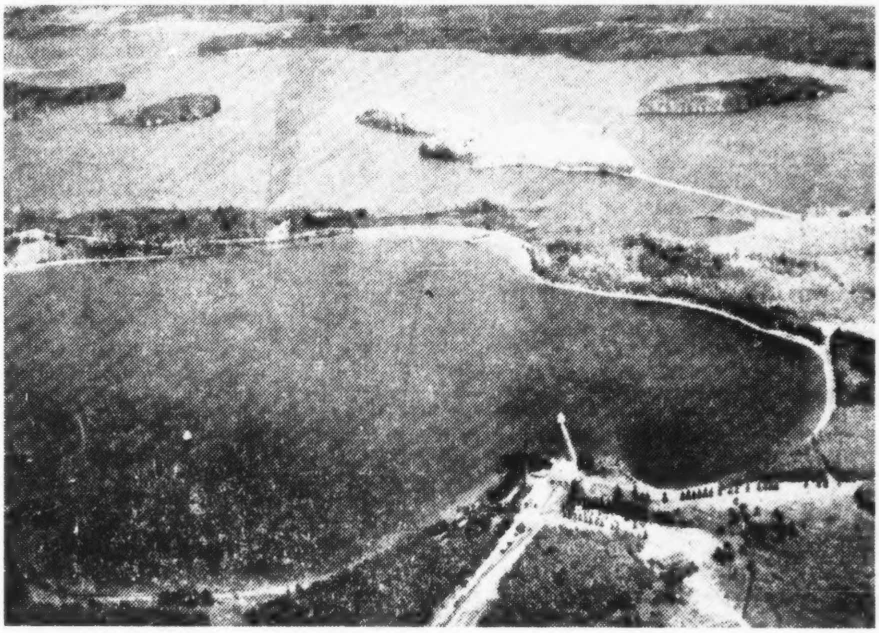
The pollution of the middle and lower portions of major streams is a problem, Berger says. A number of deterrents to river cleanup in many areas have been cited.

The traditional dependence of large municipalities on publicly owned and rigidly controlled watersheds for drinking water supply, rather than on major streams of the region, removes an important force for water quality control. However, as the metropolitan areas of the region increase in population and expand in area, it is becoming more and more difficult to plan on the use of new such watersheds, Berger noted.

Recent attempts to do so have been met with resistance from recreational interests. To what extent will the drinking water supplies of urban populations depend on use of the main stem of the Connecticut River and other streams of the state? Berger asks. When will such use become necessary? How can it be expressed in terms of time phasing? What will be the influence of such planned water use on stream classifications?

"Certain areas are appar-

(Continued on Page 4)



—Standard-Times Air Photo

WATER SUPPLY for City of New Bedford includes Little Quittacas Pond in the foreground and Great Quittacas Pond, background.

Water Potential Often Wasted

(Continued from Page 1)

ently reluctant to use a regional approach to water quality management," says Berger. "With the increasing stress on the river basin-wide approach to water resources planning, it is important that retarding influences be identified and examined.

Starting Point

"A good starting point would be in those areas that have failed to develop a truly effective regional approach to water quality management in spite of many inducements to evolve this cooperative approach. Associated with this reluctance to join together for the advantage of all, is the persistence of unresolved conflicts concerning water rights on the part of neighboring or nearby municipalities.

"It has not been productive to deplore this lack of cooperation, or to point out again the opportunities for common advantage in such an approach. There appear to be factors strongly rooted in traditionalism and in other obscure aspects of municipal behavior that account for it.

"Good opportunities exist for research on the kinds of attitudes one encounters among decision-makers in such areas, and the underlying and perhaps unconscious influences that account for such attitudes," Berger said.

"Serious economic barriers to industrial waste control have been reported. In Massachusetts, as elsewhere, many industries claim that the cost of controlling waste is prohibitive, and that any requirement that they do so may place them at a competitive disadvantage or force them out of business."

Evaluation Difficult

It is almost impossible for the public official to evaluate this factor. This problem often has been experienced, but it can be expected that it will become acute when attempts are made to raise the quality classification of streams.

What should be the public policy in the face of this claim by industry? What institutional experience and devices are available to the regulatory agency? To what extent should this agency be expected to examine the equities of the case? What methodology is available in doing this? Berger asks.

Storm water and overflows from combined sewers are significant unsolved pollution problems. Until effective control procedures are developed, it may not be possible for streams to meet desirable water quality criteria for use in recreation and as sources of drinking water.

The actual potential of recreational use of the river is uncertain. Proponents of recreational development of major streams base their claims on assumed projected needs of the population concerned.

Uses Involved

In certain cases, these claims have been opposed. For example, it has been said that the public would prefer swimming pools to the stream, and that the construction of such swimming pools would be much less expensive than the development of a stream for this use. A study is needed of the attitudes and actual interests of the population in recreational use of major streams, Berger says.

What recreational uses are involved? Who actually would use these benefits? What alternatives are available to satisfy this need?

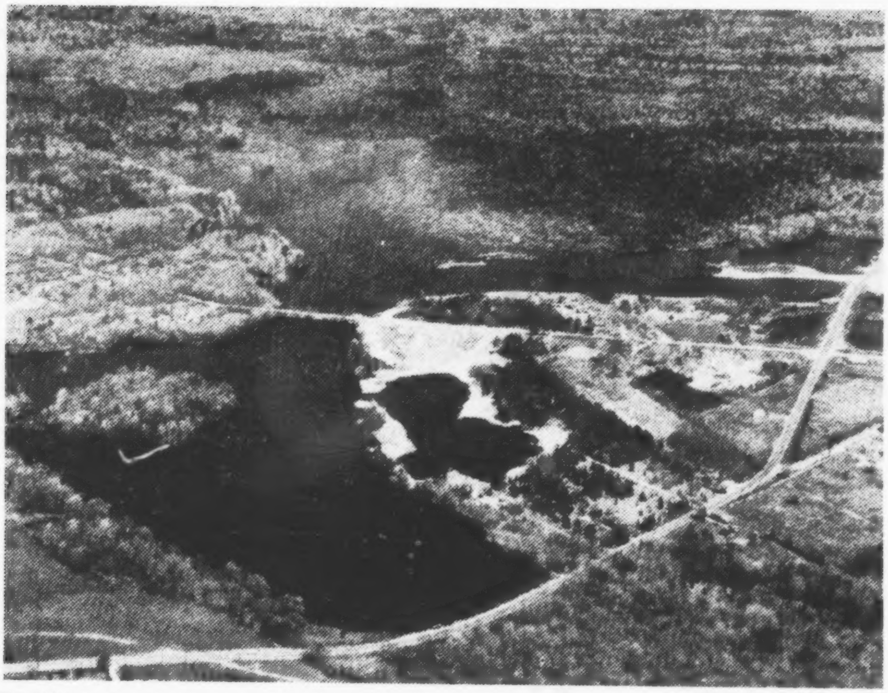
There is uncertainty in economic benefits that may be realized as a, result of rigorous water quality management. A question asked more and more frequently is: How much would it cost municipalities and industry to raise a given stretch of river from a stream classification of C to B? What economic benefits can be associated with this improvement of water quality?

It is reasonable to believe that the improvement of a major stream to permit new and expanded uses would produce economic benefits of many kinds. Proponents of stream cleanup need quantitative information concerning such benefits. The existing methodology for obtaining such data is not dependable.

Conventional methodology for planning a regional waste disposal system is relatively inefficient. The technology of optimizing such a system in terms of lowest overall cost can be improved. Planning, design and operational problems associated with large and growing urban areas require approaches based on analysis of multiple, interrelated and very complex conditions. Included in such technology are utilization of advanced waste treatment processes, stream storage for flow regulation, and waste storage for phased discharges.

An improved technology of regional waste disposal requires accurate projections of population growth and its distribution and projections of industrial development and its distribution within the urban area, Berger concluded.

(Tomorrow: Decisions on ways in which water resources are developed on small watersheds.)



DECISIONS on water resources development in small watersheds are vital. The Turner's Pond watershed comprises a complex of inland wetlands (the Acushnet Sawmills cedar swamp) and water storage facilities. It is foreseen that competition for these waters will become keener and more complex.

—Standard-Times Staff Photo by E. Milton Silvia

Poisoned Water --- 3

Control of Watersheds Increasingly Competitive

(This is the third of a series of articles concerning water resources problems of the state assessed in terms of future development of Greater New Bedford.)

By TED VINCENT
S-T Outdoors Writer

Decisions on ways in which water resources are developed in the relatively small watersheds of Massachusetts currently are made by the people and agencies of the watershed concerned, Prof. Bernard B. Berger, director of the Water Resources Research Center, University of Massachusetts, emphasized in his analysis of improvement of methodology for planning independent watersheds.

The state exercises reasonable control on such decisions, Berger said, and only in exceptional cases does it superimpose its decisions on water uses over those made internally.

By and large, the rights to the water produced in a watershed belong to the communities and other interests located in that watershed. It is clear that externally generated demands will place more stress on these waters. These demands originate in the expansion of the population in metropolitan areas of the state and the associated need for water, the growth of industry, and the ever-increasing appeal of recreational use of such waters.

It is foreseen that competition for these waters will become keener and more complex.

Pressure inevitably will be placed on the now independent watershed to fit into broad resource plans so that important regional water use requirements may be satisfied.

It is becoming increasingly important to evaluate the needs and the rights of competitive water users, including major users who claim interbasin water transfer rights; to determine the validity of estimates of water needs by municipalities, industry and agriculture; to determine the relationship between water resource development and the associated economic return to the watershed to evolve institutional arrangements appropriate to water shed management of water quality and quantity; and to understand attitudes of decision makers in respect to acceptance of rational long-range plans for water use, Berger says.

An evaluation is required of needs of competitive water users. Competition for a given water resource will certainly increase. Each of the urban areas must look to new sources of water to satisfy its future demands. In a sense, each urban area exerts a gravitational force which places a stress on a given watershed and influences the development of a water-use plan. Moreover, not only will the extra-watershed urban areas compete with each other, they will compete with intrawatershed, community water supplies, industry, recreational interests, and agriculture.

The Question Is . . .

"The research question is: How do the planners evaluate the various water demands and make rational decisions based on over-all public good?" he asks.

The validity of estimates of water need by municipalities, industry, and agriculture must be examined. It is clear that under the stress of the recent water shortage, economies in water use have been effected without sacrificing essential requirements It seems irrational to permit wastage of water even where supplies are temporarily abundant, Prof. Berger noted.

The long-range plan must assume that such wastage will have been eliminated.

"The questions that remain for the planner are: What assumptions on unit water allowances should be permitted in the plan for the various competing water users? How can pricing policy be best used to reduce water demand?"

The relationship of water resource development to economic benefit of the watershed should be studied. The large number of alternatives that must be considered in determining desirable combinations of future water uses makes this an interesting problem in economics and planning. In addition, it seems reasonable to assume that the degree to which land values will be enhanced will influence the nature of long-range planning. In this connection, it is realized that land values may be depressed with certain uses of water resources.

Adverse Effect

For example, approval of the use of the water resource to receive poorly treated liquid waste from industry will certainly have an adverse effect on adjacent land value.

On the other hand, the use of the water resource for recreational purposes may be of great benefit to a few and to the economic disadvantage of others. Research on economic projections as related to water resource development is important, Berger commented.

Means must be evolved for obtaining an effective watershed-wide administration of the water resource. The problem of the multiple political entities within the watershed is recognized as a major factor in planning and water resource development. The research question applies to the nature of the new administrative institution that is most compatible with the tradition and needs of the area.

An optimum long-range plan must take into account the attitudes of decision makers in respect to their willingness to accept the plan.

Merely an Exercise

Any such plan would remain simply an exercise in the techniques of planning if it did not have the support of the people who have to make the plan operative.

The research question is: How can significant attitudes be objectively characterized, evaluated, and incorporated into the planning operation?

Disputes on water rights undoubtedly will become more acute when the planning agency attempts to make decisions on allocations among water users. Conflicts are already present in many areas because of the many acts of legislation dating back to the early days of the commonwealth and before.

Clarification of existing rights and identification of legislative needs in respect to water laws are essential to sound water resource planning, Berger noted.

(TOMORROW: Pollution in salt water estuaries reduce or destroy value of important shellfish areas; high level of waste treatment costly.)

Poisoned Water --- 4

Cleanup of Estuaries Source of Arguments

(This is the fourth of a series of articles concerning water resources problems of the state assessed in terms of future development of Greater New Bedford).

By TED VINCENT

Standard-Times Outdoor Editor

In covering the problem of accelerating the cleansing action of estuaries, Bernard B. Berger, director of the Water Resources Research Center, University of Massachusetts, said that the major estuaries of Massachusetts, like those elsewhere, are depositories of pollutional material contained in tributary streams.

The pollutants, Professor Berger noted, consist of inadequately treated wastes and in drainage from land areas bordering on the estuaries. Most estuaries contain a heritage of pollution in the form of bottom deposits of slowly decomposing sludge.

These materials exert a constant pollutional effect on the overlying waters and at the same time they reduce or destroy the value of important shellfish areas and other fisheries. The situation is bad now and it certainly will become worse." says Berger.

Arguments Presented

From time to time, strong arguments are presented for the cleanup of these water resources. Often, these arguments are met with counter arguments to the effect that a high level of water quality should not be expected or be required in estuaries.

It has been stated that the economic value of shellfish beds and other fisheries resources within the estuary does not justify the utilization of a high level of waste treatment. While it is recognized that natural bathing areas must be protected for the reasons of public health and that gross pollution must be prevented to preserve esthetic appearance, it is believed by some that the economic justification for treatment beyond these requirements does not exist, Berger says.

He poses these questions:

"A number of important research challenges are presented: How may patterns of urban population, industrial, and recreational development be projected in terms of their

(Continued on Page 3)

Area Estuaries Pose Problems

(Continued from Page 1)

influence on estuarial water quality and on water quality criteria?

"How dependable are procedures for determining the costs of attaining the desired water quality objectives and the value of the water uses to be protected?

"What pollutional effects are exerted by bottom deposits in estuaries? What stabilization factors are naturally present and what are the rates of stabilization? How may such deposits be eliminated or controlled most effectively?

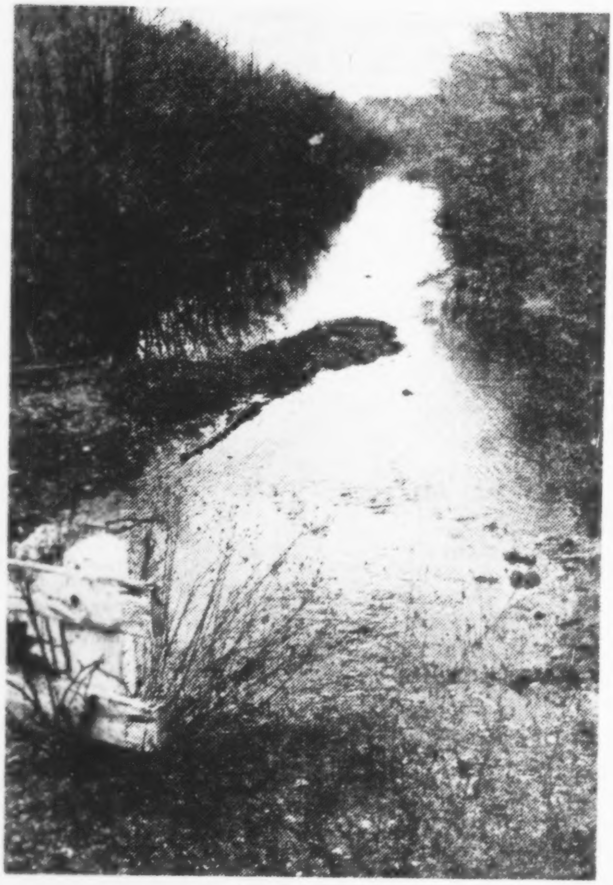
"What is the determination of the role of wetlands in the development of an area?"

Massachusetts has experienced strong contention with respect to the need for preservation of wetlands. On the one hand are land developers who claim that drainage of wetlands is essential to a desirable regional land use plan.

On the other hand are those who are concerned that elimination of wetlands might have far-reaching effects on the ecology of the region, the maintenance of groundwater supplies, and the control of floods.

It appears desirable that a comprehensive study be made of wetlands to determine their significance in the total water regimen of a region and their importance to the maintenance of a desirable aquatic and wild life population.

Massachusetts shares other problems with the rest of the nation in addition to those outlined. Most important are the problems associated with flood control, hydropower generation, propagation of fish and wildlife, use and reuse of water by industry, projected agricultural requirements, groundwater intelligence, recreation, and water resource development for navigation, Prof. Berger noted.



—Standard-Times Staff Photo by E. Milton Silvia

EROSION AND DEBRIS — Some streams feeding New Bedford's water supply, like Black Brook, as shown, need dredging and clearing of vegetation to flow more freely.

Problem Becomes Acute

The water resources problems of Massachusetts are reflected in the water problems of Greater New Bedford. While the question of multiple use of drinking water impoundments is becoming acute, New Bedford's Water Department is facing problems in its limited-use recreational program on the city's drinking water supply reservoirs.

Recreation oriented groups are inclined to protest the elimination of recreational activities on a watershed preempted for drinking water use only, but the problem with limited multiple use of drinking water impoundments is financing recreational facilities.

The Water Department budget cannot provide funds for boat launching ramps, sanitary stations and policing of the open areas, which are necessary to meet the health requirements dictated by the state, Berger concluded.

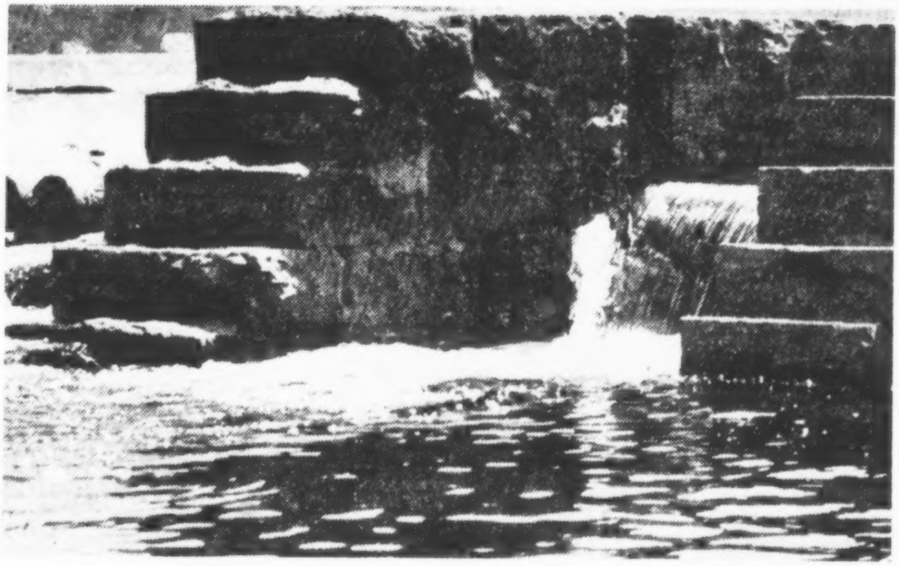
Like the water resource problems of the state, New Bedford must find solutions to its own water resource problems, which include conservation and optimum use of watershed lakes in long-range planning for the future; maximum use of the Acushnet River in respect to navigation, industrial processing and cooling water, recreation and shellfish propagation.

Elimination of the waste of water in the Nemasket River basin; meeting water quality standards in the inner harbor area of the Acushnet River and pollution control of industrial wastes and domestic sewage are water resources headaches that must be solved.

(TOMORROW: New Bedford's water resources problem . . . too much water going over the dam.)

Poisoned Water — 5

Storage Necessary to Conserve Water



—Standard-Times Staff Photo by David Crowell

WATER OVER DAM — New Bedford's water resources problem is too much water for its present reservoirs. State water officials estimate 60 million gallons are lost daily during high water periods, flowing out of the system, over a dam and down Nemasket River.

Flood Control Termed Vital

(Continued from Page 1)

(This is the fifth in a series of articles concerning water resources problems of the state assessed in terms of future development of Greater New Bedford.)

By TED VINCENT
Standard-Times Outdoors Writer

New Bedford's water resources problems — somewhat different from the rest of the Northeastern region's water difficulties — is that it has too much water for its present reservoirs.

"With better storage facilities," Water Department Superintendent George H. Brightman says, "we could just as easily fill all the needs of Southeastern Massachusetts."

The first step to enlarge water storage at Great and Little Quittacas Ponds was approved at a New Bedford Water Board meeting Oct. 5, 1966. The site is the sole water reserve where the city owns all shore surrounding water reserves.

The problem faced in all of the Lakeville Ponds that constitute the reservoir system for Taunton and New Bedford — Assawompsett, Pocksha, Great Quittacas, Little Quittacas and Long Ponds — is their shallow depths. Plans to enlarge their water storage capacity center on one of two decisions — to deepen their bottoms by dredging or to raise the water level by flooding more of the land area.

There are certain disadvantages to either choice. Dredging might destroy the present firm character of the bottoms and result in a more porous condition that would fail to hold the water reserve. Raising the water levels would result in flooding private property.

The Lakeville ponds watershed covers 47.2 square miles with water area comprising 5,803.2 acres and land area of 2,437.2 acres. With increased storage capacity of the reservoir system, New Bedford could easily become the focal point of regional water resources.

City Planner Robert E. Stewart says Mayor Edward F. Harrington is interested in developing the regional aspect of maximum water supplies.

Under this plan, Stewart said, New Bedford would pump water to the individual towns for storage in those areas. The towns would then shoulder the responsibility of managing water resources including cleansing treatment, and each town would manage and set water rates to individual users. Under this plan there would be several systems within a region, Stewart said.

Three-fold Problem

New Bedford's water resources problem is three-fold State water officials estimate 60 million gallons are lost daily, flowing out of the system, over a dam and down the Nemasket River.

The dam where the river flows out of Assawompsett Pond is old and inadequate. Water officials believe if the dam broke or was opened, the resulting loss would lower the level of the water supply system two or three feet.

Even if the dam were in perfect condition, the runoff could not be prevented without expensive flooding of privately-owned property.

In May of last year at a hearing in Waltham, Mayor Harrington appealed to the U.S. Army Corps of Engineers for federal aid in overcoming New Bedford's water supply problems.

In reply to the mayor's question, "How long?" Brig. Gen. F. P. Keish, North Atlantic division engineer said, "It is important to recognize that even for urgent projects, a substantial period of time will be required for the engineering and economic analysis, for effective coordination, and for the legislative and budgetary processes involved."

Planner Assigned

Following the Waltham meeting, Harrington learned that federal planner Joseph F. Miliane has ben assigned to a five-year water resource survey to pinpoint needs in Southeastern Massachusetts.

One regional water construction program pushed by the city entails damming areas of the Taunton River and deepening ponds in the New Bedford water storage area. Miliano, working out of the Corps of Engineer's Waltham office, is expected to gather information from New Bedford, Taunton, Fall River and other Southeastern Massachusetts communities concerning current sources, where they are located and community needs 30-50 years from now. Miliano told the Water Board that all the work proposed in the five-year study plan would be scheduled for completion sometime around the year 2020.

A $56,439 one-year grant has been awarded to the Southeastern Massachusetts Regional Planning District by the Department of Housing and Urban Development. William E. Barbour, executive director of the planning district, said a major portion of the grant will be used to finance the district's completion of a sewer and water resources master plan for the area.

Demand to Double

By the year 1980 Greater New Bedofrd's demand for water is going to double water experts predict. And then the demand will almost double again by the year 2000.

Because people want water for many uses, recreational as well as municipal and industrial, public concern over water resources is at an all-time high.

What is going on in water resources development today amounts in some ways to a revolution, yet there is no great overthrow of what existed before. Rather, the old problems are being approached with new concepts, new laws, new relationships. Old tasks are taking on new complexities and old patterns no longer apply. Every public official in the water resources field must take a new look at his work.

Management Is the Key

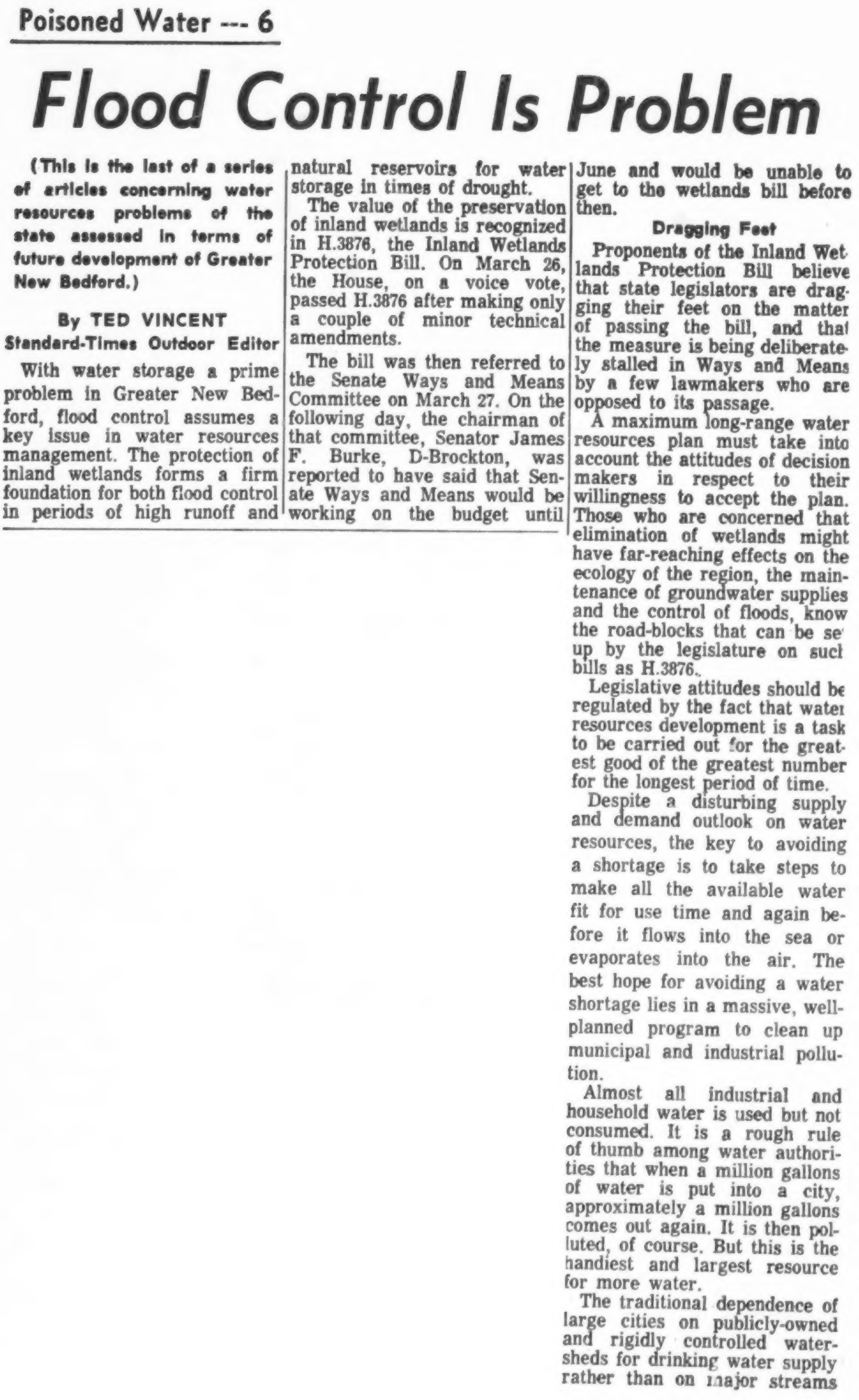
Proper water management is the key. That means many things: Pollution control and pollution abatement to protect the quality of water; transfer of water from one river basin to another; storage of heavy runoffs to prevent floods and at the same time, save water for future use.

Water resources development in this era is a task of the entire community, to be carried out for the greatest good of the greatest number for the longest period of time.

It is not simply a matter of engineering. For although the means used in the achievement of the common goal may be technological, their application is determined and decided on the basis of civic choice and political acceptance.

For all participants in this field, the search for the best solution and fitting are efforts into it when found, is a major — perhaps the decisive — part of the new look in water re-

(Tomorrow: With water storage a prime problem, flood control assumes a key issue.)



Poisoned Water --- 6

Flood Control Is Problem

(This is the last of a series of articles concerning water resources problems of the state assessed in terms of future development of Greater New Bedford.)

By TED VINCENT
Standard-Times Outdoor Editor

With water storage a prime problem in Greater New Bedford, flood control assumes a key issue in water resources management. The protection of inland wetlands forms a firm foundation for both flood control in periods of high runoff and natural reservoirs for water storage in times of drought.

The value of the preservation of inland wetlands is recognized in H.3876, the Inland Wetlands Protection Bill. On March 26, the House, on a voice vote, passed H.3876 after making only a couple of minor technical amendments.

The bill was then referred to the Senate Ways and Means Committee on March 27. On the following day, the chairman of that committee, Senator James F. Burke, D-Brockton, was reported to have said that Senate Ways and Means would be working on the budget until June and would be unable to get to the wetlands bill before then.

Dragging Feet

Proponents of the Inland Wetlands Protection Bill believe that state legislators are dragging their feet on the matter of passing the bill, and that the measure is being deliberately stalled in Ways and Means by a few lawmakers who are opposed to its passage.

A maximum long-range water resources plan must take into account the attitudes of decision makers in respect to their willingness to accept the plan. Those who are concerned that elimination of wetlands might have far-reaching effects on the ecology of the region, the maintenance of groundwater supplies and the control of floods, know the road-blocks that can be set up by the legislature on such bills as H.3876.

Legislative attitudes should be regulated by the fact that water resources development is a task to be carried out for the greatest good of the greatest number for the longest period of time.

Despite a disturbing supply and demand outlook on water resources, the key to avoiding a shortage is to take steps to make all the available water fit for use time and again before it flows into the sea or evaporates into the air. The best hope for avoiding a water shortage lies in a massive, well-planned program to clean up municipal and industrial pollution.

Almost all industrial and household water is used but not consumed. It is a rough rule of thumb among water authorities that when a million gallons of water is put into a city, approximately a million gallons comes out again. It is then polluted, of course. But this is the handiest and largest resource for more water.

The traditional dependence of large cities on publicly-owned and rigidly controlled watersheds for drinking water supply rather than on major streams removes an important force for water quality control.

Examination Important

With the increasing stress on the river basin-wide approach to water resources planning, it is important that retarding influences be identified and examined. Many industries claim that the cost of controlling waste is prohibitive, but the job must be done.

Destruction of estuarine areas by pollution, by dredging to improve navigation channels or harbors, or by bulkheading or filling threatens commercial and sport fisheries and wildlife populations. Estuaries are critically important in maintaining the food chain of water and water-dependent creatures.

Water quality management and land and shoreline management must be included in long-range water resources planning.

In New Bedford, combined sewers carry away both water polluted by human use and water polluted as it drains off homes, streets or land during a storm. Much of the combined storm and sanitary water bypasses the municipal treatment plant because of increased water volumes. Thus, completely untreated sewage enters Clarks Cove during storm periods.

Shellfishing Stopped

The State Department of Public Health has frequently ordered Clarks Cove, the Acushnet River and New Bedford Harbor closed indefinitely for shellfishing because of pollution.

A plan to combat pollution of Massachusetts' rivers by establishing special river district commissions to clean up the waters for recreation, industry and commerce has been referred to the House Ways and Means Committee for a cost analysis.

New Bedford is getting a $127,000 federal grant to plan an estimated $4.7 million sewage treatment plant. The plan is the key project in the city's proposed 30-year sewer capital improvement program. Preliminary plans for the plant were completed more than three years ago, but selection of a site was delayed by substantial debate.

A major project in the $40-$45 million sewer program involves separation of the surface water system from the sewer system.

No Easy Solutions

There are no easy or single solutions to water problems, no universal cures. The expenditure of necessarily large sums will not work unless science and wisdom are engaged simultaneously on water resources projects and all interests are considered in plans for the long range.

The healthy population growth and industrial development of Greater New Bedford depends on it. The regional water resources must be cleaned up and shared, not dismembered. Their development and their sharing must be planned through cooperation.

No considerable body of water resources can be reserved for any one use alone. All the manifold planning and development tasks of water resources management must be undertaken in a spirit that will search for common viewpoints and common goals.

Our lives depend on it.

Water Pollution Progress Noted

—Standard-Times Staff Photo by Ronald Rolo

WATER EXPERTS — Arthur W. Brownell, director of Massachusetts Division of Conservation Services, Thomas C. McMahon, director Division of Water Pollution Control, John D. Fiske, marine biologist, Division of Marine Fisheries and Malcolm E. Graf, director of the New England River Basins Commission, left to right, study the agenda of the forum on water resources held at Dartmouth High School yesterday. The state water authorities were panelists at the forum.

State Control Plan To Cost $½ Billion

By TED VINCENT
Standard-Times Staff Writer

The piecemeal efforts of local governments to plan and manage water resource projects is passe, Malcolm E. Graf, director of the New England River Basins Commission, with offices in Boston, told a conservation-minded audience at Dartmouth High School yesterday.

Graf, one of four panelists, forming a forum on water resources entitled, "Water, Water, Dirty Water," cited federal and state laws that resulted in federal, state and local governmental agencies to work together in the development and management of water resources.

The increasing demands on water supplies by an exploding population and expanding industry places new stresses on our water supplies, Graf said.

He also noted the increased demands on water recreation in the 1960s, and noted that conservationists are in favor of opening up access to the state's great ponds and ocean frontage until such "access points" affect the "do-gooders" personally. Then they oppose "the rights" of the public.

Public Must Be Considered

The public must be considered in the development and management of water resources uses, Graf insisted.

The New England River Basins Commission was established in 1965 by petition of the six governors of the region, and was the fourth such commission to be created in the U.S.

Graf said the commission in cooperation with the Department of Natural Resources, the Department of Public Health, the Metropolitan District Commission, the Department of Agriculture and the Department of Commerce and Development acts as a clearing house for water resource development and management proposals. And also directs studies designed to meet future water needs of New England.

Thomas C. McMahon director of the Massachusetts Division of Water Pollution, outlined the federal and state laws that established water quality criteria and pollution control. McMahon told his listeners that Massachusetts earmarked $150,000,000 for pollution abatement and control.

He noted that Massachusetts had met the crisis with a bond issue to meet state financial obligations until reimbursed by the federal government.

State 5th in Nation

McMahon said that Massachusetts was the fifth state in the nation to have its water quality standards approved by the federal government. This action followed seven public hearings conducted throughout the state McMahon said.

Progress has been made in the state's water pollution abatement program, McMahon noted, in the divison's 18 months of existence. Twenty-three industries and 130 communities have been given grants under the division's water pollution control project approval plan. McMahon also told his listeners that 96 per cent of the industries cited for causing pollution had replied and that 95 per cent said they would comply with recommendations for pollution abatement.

McMahon said that it would take five to seven years to complete the divisions water pollution control program at an estimated cost of $500,000,000.

State fisheries biologist John D. Fiske showed color slides of estuarine salt marshes and marsh streams. Fiske commented of the value of salt marshes in contributing nutrients to the food chain of marine life, and the benefits of shellfish and finfish to the region's economy. He cited an example of two fishermen who netted mummichogs for bait to the sportfishing market at an income of $10,000 a year for each man.

Notes Estuarine Value

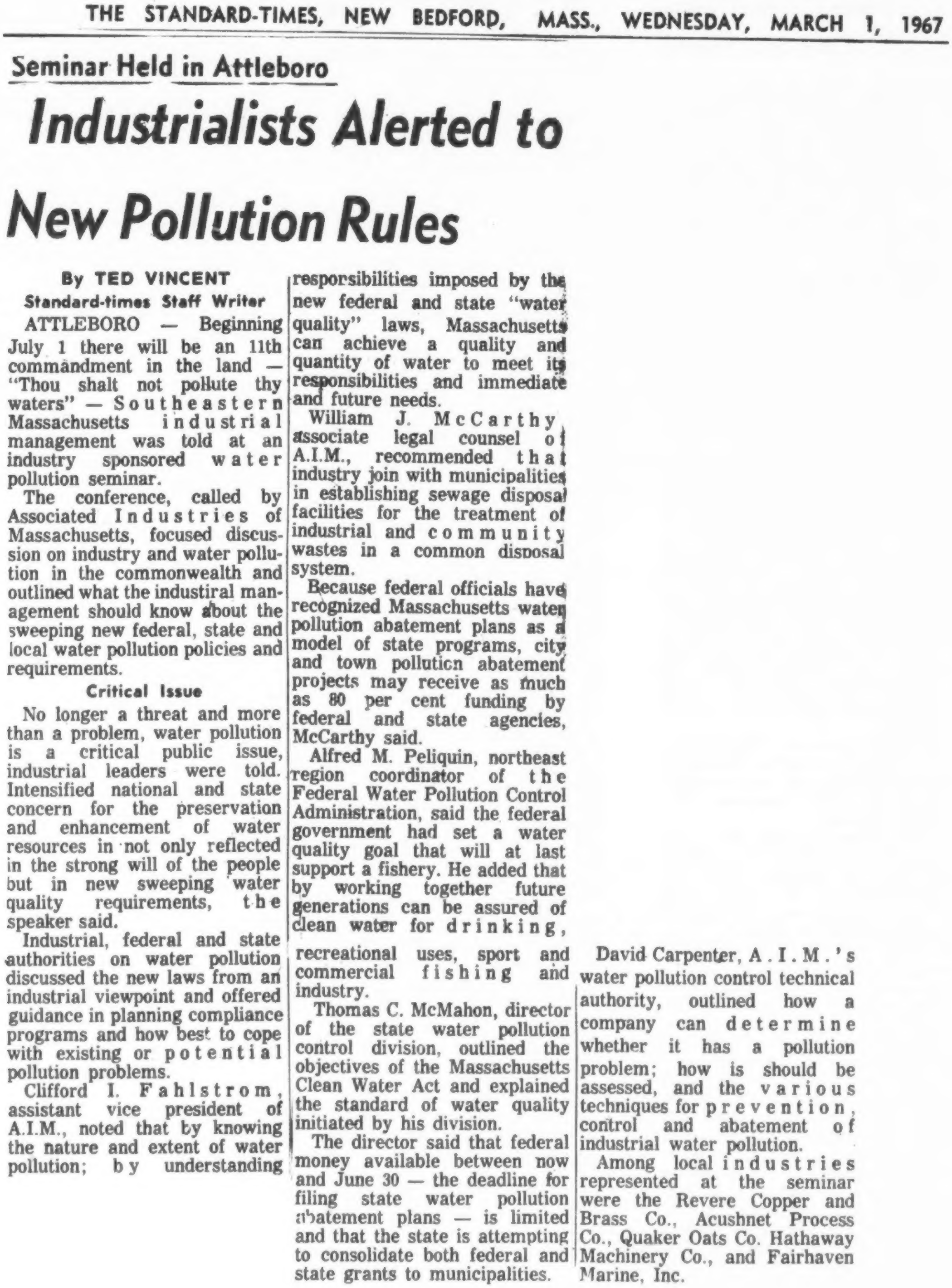
Fiske also noted the value of estuarine basins as nursery areas for food fish and shellfish. He cited the value of softshell clams, quahogs, and blue mussells to commercial fishermen, adding that sales of shellfish by commercial fishermen total in the hundreds of thousands of dollars in many coastal towns.

Fiske outlined the provisions of the Jones Law which protects the coastal wetland from dredging and filling by commercial developers. In answer to a direct question, Fiske replied that the Jones Law has been effective in curbing dredging and filling of marshes in the Cape Cod area, and to his knowledge no violations of the law have occurred recently.

Using salt marshes as a dumping ground is still evident around metropolitan areas, Fiske said and proved it with illustrations.

Brownell said that the Inland Wetlands Bill passed in mid-June was not the complete answer to wetlands preservation. He recommended that town, county and state conservation agencies acquire these vital conservation areas to assure long-range protection. He noted the role that inland wetlands play in flood control and water storage which preserves the water table during periods of drought.

The water resources forum was sponsored by the League of Women Voters in Dartmouth and the garden clubs of Southeastern Massachusetts.



THE STANDARD-TIMES, NEW BEDFORD, MASS., WEDNESDAY, MARCH 1, 1967

Seminar Held in Attleboro

Industrialists Alerted to New Pollution Rules

By TED VINCENT
Standard-times Staff Writer

ATTLEBORO — Beginning July 1 there will be an 11th commandment in the land — "Thou shalt not pollute thy waters" — Southeastern Massachusetts industrial management was told at an industry sponsored water pollution seminar.

The conference, called by Associated Industries of Massachusetts, focused discussion on industry and water pollution in the commonwealth and outlined what the industiral management should know about the sweeping new federal, state and local water pollution policies and requirements.

Critical Issue

No longer a threat and more than a problem, water pollution is a critical public issue, industrial leaders were told. Intensified national and state concern for the preservation and enhancement of water resources in not only reflected in the strong will of the people but in new sweeping water quality requirements, the speaker said.

Industrial, federal and state authorities on water pollution discussed the new laws from an industrial viewpoint and offered guidance in planning compliance programs and how best to cope with existing or potential pollution problems.

Clifford I. Fahlstrom, assistant vice president of A.I.M., noted that by knowing the nature and extent of water pollution; by understanding responsibilities imposed by the new federal and state "water quality" laws, Massachusetts can achieve a quality and quantity of water to meet its responsibilities and immediate and future needs.

William J. McCarthy, associate legal counsel of A.I.M., recommended that industry join with municipalities in establishing sewage disposal facilities for the treatment of industrial and community wastes in a common disposal system.

Because federal officials have recognized Massachusetts water pollution abatement plans as a model of state programs, city and town pollution abatement projects may receive as much as 80 per cent funding by federal and state agencies, McCarthy said.

Alfred M. Peliquin, northeast region coordinator of the Federal Water Pollution Control Administration, said the federal government had set a water quality goal that will at last support a fishery. He added that by working together future generations can be assured of clean water for drinking, recreational uses, sport and commercial fishing and industry.

Thomas C. McMahon, director of the state water pollution control division, outlined the objectives of the Massachusetts Clean Water Act and explained the standard of water quality initiated by his division.

The director said that federal money available between now and June 30 — the deadline for filing state water pollution abatement plans — is limited and that the state is attempting to consolidate both federal and state grants to municipalities.

David Carpenter, A.I.M.'s water pollution control technical authority, outlined how a company can determine whether it has a pollution problem; how is should be assessed, and the various techniques for prevention, control and abatement of industrial water pollution.

Among local industries represented at the seminar were the Revere Copper and Brass Co., Acushnet Process Co., Quaker Oats Co. Hathaway Machinery Co., and Fairhaven Marine, Inc.

Water Pollution Forum To Raise Vital Issues

The forum on water resources and water pollution scheduled by Southeastern Massachusetts garden clubs and the League of Women Voters in Dartmouth for 2 p.m. July 18 at Dartmouth High School is everyone's business.

Featuring authoritative panelists on the subject "Water, Water, Dirty Water!" the discussion periods alloted to each speaker may explore answers to one of the most vital questions of the 20th Century:

Is the U.S. running out of water? Will water troubles keep getting worse? Isn't there anything this region can do to assure adequate supplies of water, ready at the tap and free of pollution?

Flood Problems

What about floods? Can water problems be solved by trapping flood waters and then releasing them later when shortages threaten?

These and related questions are on the minds of most of us as water problems — drought, floods, pollution—spread across Southeastern Massachusetts.

Water supply and watersheds will be the topic discussed by Malcolm E. Graf, director and chief engineer of the Massachusetts Water Resources Commission. In April of this year, Graf was appointed staff director of the New England River Basins Commission, with offices in the Federal Building in Post Office Square, Boston. He will direct studies designed to meet future water needs of New England.

Proper water management is the key to the water needs of the future. Water sheds govern the water-collecting potential of the basic supply. Graf will cover these areas of discussion.

Supply Sufficient

Basically there is sufficient water in this region — both surface water and ground water. But some of the sources have become heavily polluted and are no longer usable. There is pollution by industry, pollution by municipalities and there is salt water pollution.

Thomas C. McMahon, director of the Division of Water Pollution Control in the Massachusetts Department of Natural Resources, will chair the panel in the dirty water segment of the forum.

From 1963 until 1965 McMahon served as chief of the water resources development section, Division of Water Supply and Pollution Control in the U.S. Public Health Service for New England. From 1965 to 1967 he was executive secretary of the New England Interstate Water Pollution Control Commission, headquartered in Boston.

Other speakers tying in with the discussions on water resources and water pollution are John D. Fiske, marine biologist in the Division of Marine Fisheries, who will speak on coastal wetlands, and Arthur W. Brownell, director, Division of Conservation Services, who will discuss inland wetlands.

The public is urged to attend the forum sponsored by the Aptucxet Garden Club of Bourne, Fall River Garden Club, Falmouth Garden Club, Garden Club of Buzzards Bay, Garden Club of Greater New Bedford, Marion Garden Club and the Little Compton, R.I., Garden Club.

Our Littered Landscape

TEXT: Ted Vincent

PHOTOS: Milt Silvia and Ronald Rolo

Land pollution — the festering eyesore of trash, junk and refuse littering the landscape — is perhaps the most repulsive trait of the inconsiderate and irresponsible human today.

The sharpest minds in the field of exploring human behavior have failed to analyze the kink in the human mind that permits people to create a public dump on the land about them.

Most of the trash is simply careless littering. Most of the junk is dumped by the inconsiderate and the irresponsible. The problem is littering by a careless public that does not recognize its responsibility to keep the landscape clean and to protect its natural beauty.

Littering, a serious national problem, begins at home. Probably the most flagrant example of land pollution is the open town and city dumps. Tons of trash and junk are dumped daily in Greater New Bedford on public town disposal areas. Most of these open dump areas carry specific restrictions on the dumping of garbage, but residents sidestep the prohibition by wrapping the refuse in packages.

In New Bedford, the city incinerator handles tons of refuse in a day's burning, but an overflow of trash and junk spills into an open dump.

Perhaps the habit of disposing of all manner of household trash on the town or city dumps contributes to the tendency of people who find the landscape — no matter the beauty or the public health factor — a convenient place to abandon an auto body, refrigerator or toss out a bag of trash.

No matter what motive underlies the slovenly practice of the litterbug, the fact remains that our environment is becoming a massive public dumping ground . . . an open invitation to surround us with filth, disease and pestilence, which in some instances spills over into our waters and adds to the problem of cleaning up water pollution.

No one knows better than the sportsman how a mere handful of discarded rubbish can deface an otherwise beautiful woodland setting or stream. Sportsmen should be aware that litter prevention is an important part of conservation and should cooperate as much as possible with anti-litter campaigns. The nation's hunters and fishermen are among those being hurt most by the effects of thoughtless littering in rural areas.

Ironically, outdoor sportsmen are the least offenders, according to a recent survey by Keep America Beautiful, Inc. Hunters and anglers accounted for only 5 per cent of the litter in the rural areas investigated, while picnickers were said to leave 25 per cent and passing motorists 70 per cent.

Some 13 states report that land is being closed to hunters because of littering, and some states report that littering contributes to the posting of lakes and streams. Twenty-two stated that litter is detrimental to fish life.

The Keep America Beautiful survey noted that most states are making a determined effort to combat water litter.

An intensive campaign to clean up the public lands and to protect their natural beauty was announced by Boyd L. Rasmussen, director of the Interior Department's Bureau of Land Management, speaking to the 41st annual convention of the Outdoor Writers Association of America.

"This land is your land," Rasmussen told the writers. "It is your land and mine and every other American's and that makes us all responsible for cleaning it up and keeping it clean."

Rasmussen also introduced the symbol of the new national anti-litter campaign -- a lean, square-jawed outdoorsman called Johnny Horizon — "the spirit and conscience of every American who loves and respects the land and wants to protect it."

Rasmussen said that use of the public lands for all kinds of outdoor recreation continues to increase rapidly, and that costs of cleanup of careless littering are staggering, running into millions of dollars annually. In the natioal forests, some $2.5 million is budgeted each year for cleanup.

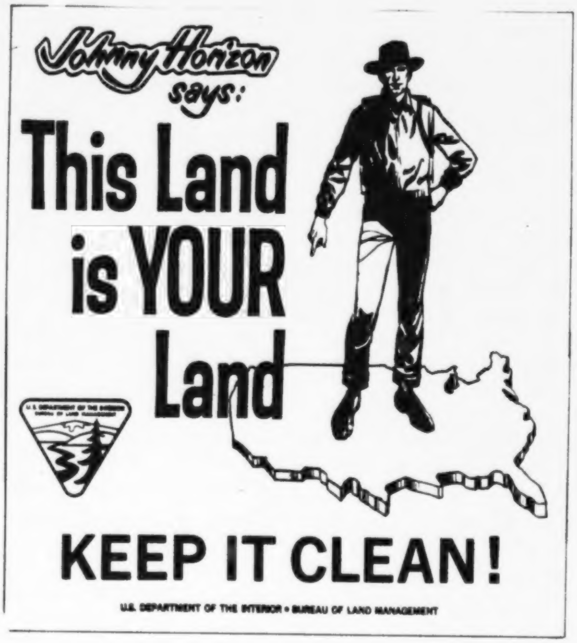
Francis X. Kelly, chief of press relations in the National Park Service, says the service does not compile the actual cost of cleanup. Each park superintendent has a budget which he must use to operate his park. A certain amount is required for maintenance, including cleanup. But, said Kelly, an estimated $1.75 million is used annually for cleanup in the national parks.

Obviously, something must be done on the problem of littering the landscape, locally, statewide and nationally.

Rasmussen said we must go directly to the public owners of the land, both the considerate and the inconsiderate. We need the help of all. The considerate will do their part. We hope the inconsiderate will develop better manners. People must realize it is their own "backyard" they are messing up.

Keep America Beautiful reports the number of litter receptacles installed along state highways is increasing yearly. Allen H. Seed Jr., executive vice president of KAB, said providing adequate facilities for refuse disposal is a prime requisite for litter prevention and beautification.

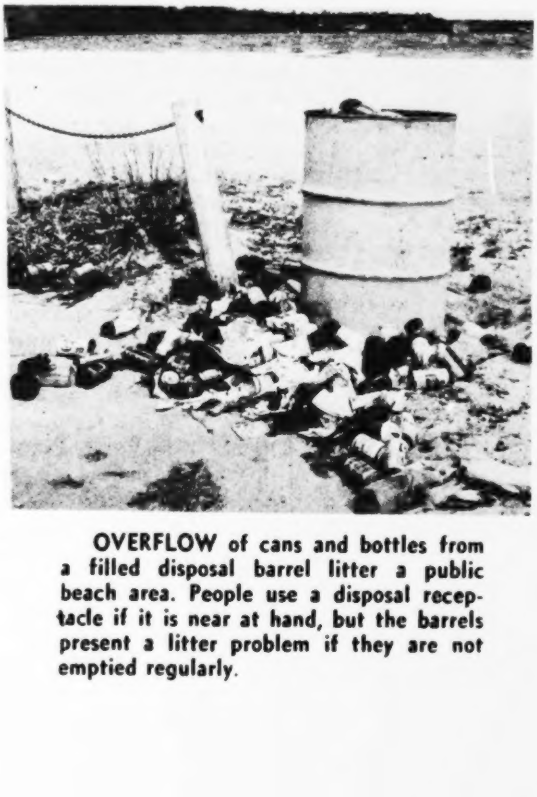
"Most people do go straight to the litter basket with their refuse when one is nearby," Seed said.


Johnny Horizon says:
This Land is YOUR Land
KEEP IT CLEAN!
U.S. DEPARTMENT OF THE INTERIOR • BUREAU OF LAND MANAGEMENT

NEW NATIONAL SYMBOL of anti-litter campaign, Johnny Horizon, a lean, square-jawed outdoorsman, is "the spirit and conscience of every American who loves and respects the land and wants to protect it."

The New Bedford Sunday Standard-Times — September 1, 1968

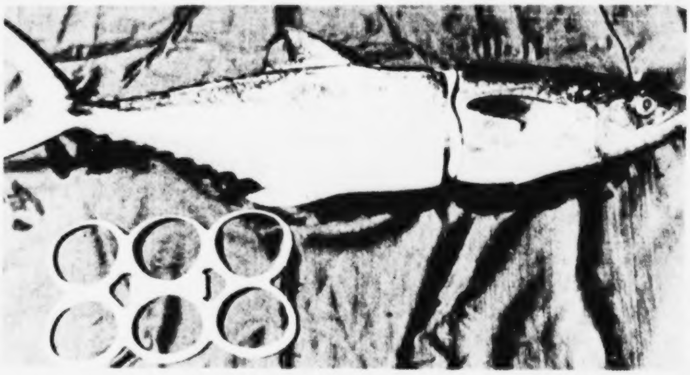
TOWN DUMP beside the river contributes to two forms of pollution—land and water. During flood periods buoyant trash floats into the Acushnet River and adds to the pollution of New Bedford Harbor.

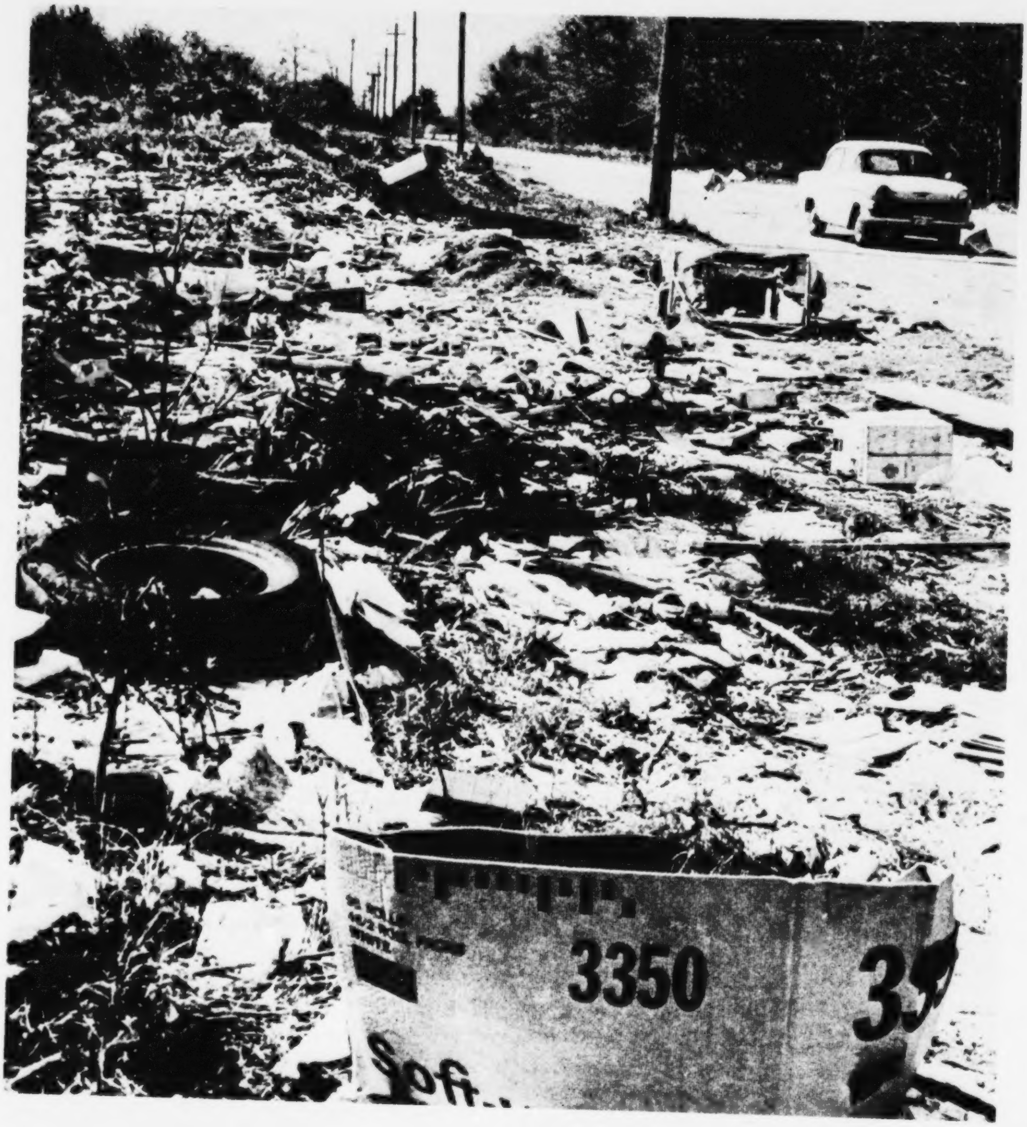


OVERFLOW of cans and bottles from a filled disposal barrel litter a public beach area. People use a disposal receptacle if it is near at hand, but the barrels present a litter problem if they are not emptied regularly.

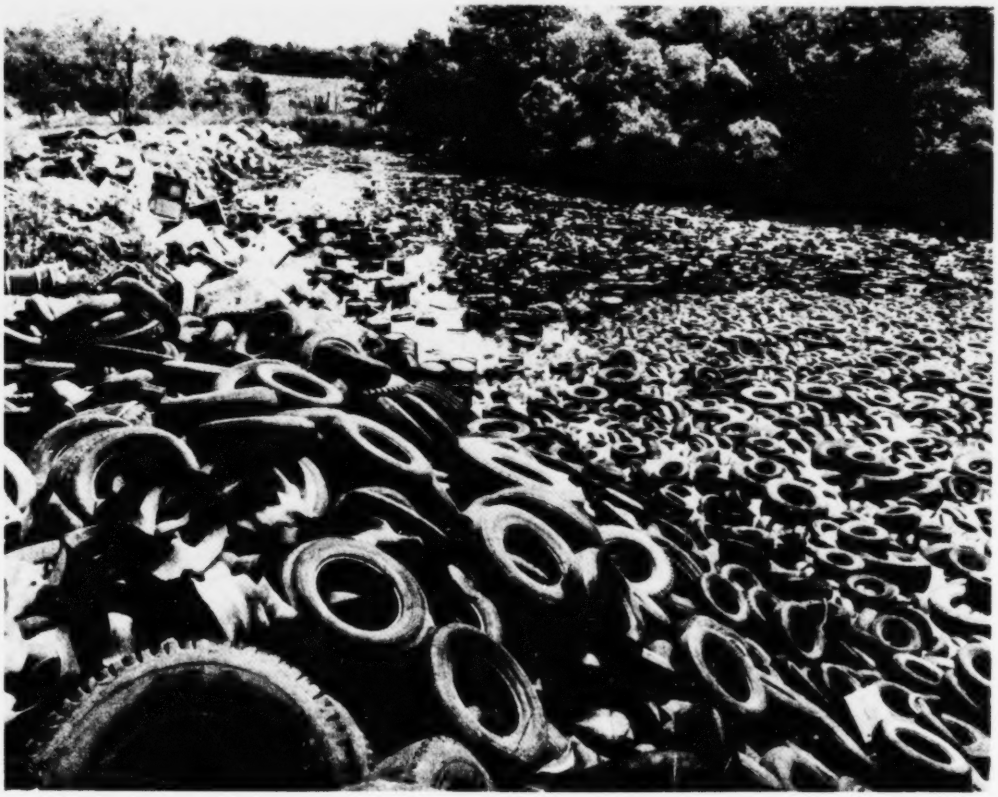
OPEN DUMPING at the New Bedford incinerator illustrates the habit of landscape pollution. The practice breeds rats and provides fuel for dump fires, which causes another health hazard — air pollution.

LITTERING our waters is a threat to fish. This spanish mackerel was girded by one of the plastic rings from a six-pack of beer. As the fish grew, the ring cut deeper into the body, finally affecting the digestive process and killing it.





ROADSIDE DUMP on Shawmut Avenue. When people find the gates to the New Bedford incinerator closed, the closest open space at the entrance becomes a dumping area. Jaycees cleaned up this road in June, but irresponsible residents continue to dump rubbish on the road. Two wind-blown cartons can be seen bouncing across the road in front of and to rear of the car.



JUNK TIRES, discarded oil barrels and cardboard cartons choke a small stream on Hathaway Road near the new Holiday Inn. The stream flows into the Paskamansett River. Stagnant water in tires is a prime mosquito breeding source.

APPENDICES

List of Participants at Boston, Massachusetts
Public Meeting, October 8, 1968. 191

List of Other Attendees at Boston, Massachusetts
Public Meeting, October 8, 1968. 193

Name	Address
Speakers	
Alperin, Irwin M.	Assistant Director, Mass. Div. of Marine Fisheries, 100 Cambridge Street, Boston, Mass. 02202
Backoff, Frank	Mass. Marine Fisheries Advisory Committee & Izaak Walton League, 551 W. Water Street, Rockland, Mass.
Blandin, Warren W.	Waterfowl Biologist, Mass. Div. of Fisheries & Game, Field Headquarters, Westboro, Mass. 01581
Bumpus, Dean F.	Senior Scientist, Woods Hole Oceanographic Institution, Woods Hole, Mass. 02543
Carriker, Melbourne R.	Director, Systematics-Ecology Program Marine Biological Lab., Woods Hole, Mass. 02543
Cole, Dr. Charles F.	Assoc. Prof. Fishery Biology, University of Massachusetts, Holdsworth Hall, Amherst, Massachusetts 01002
Conover, Dr. John T.	Biological Oceanographer, P. O. Box 97, Hyannis, Mass.
Conrod, Alfred C.	Engineer, Massachusetts Institute of Technology Experimental Astronomy Laboratory Bldg. N51-311, Cambridge, Mass. 02139
Di Carlo, Rep. Joseph C.	State Representative, State House, Boston, Massachusetts
Harleman, Donald R.	Professor of Civil Engineering, Massachusetts Institute of Technology, Room 48-213 Cambridge, Massachusetts
King, James	Legislative Assistant to Senator Edward M. Kennedy, JFK Federal Bldg., Boston, Mass. 02203
La Roque, Paul K.	Communications Director, New North River Association, 35 Felt Street, Salem, Mass.
Lebourveau, John W.	Environmental Engineer, New England Electric System, 441 Stuart Street, Boston, Mass.
Loring, Richard N.	Vice President, Aquacultural Research Corp., P. O. Box 597, Dennis, Massachusetts
Lyman, Henry	Publisher, Salt Water Sportsman 10 High Street, Boston, Massachusetts

Name	Address
Speakers	
Marshall, Roger	Chairman - Eastern New England Group, The Sierra Club, 33 Linnaean Street, Cambridge, Massachusetts 02138
Mofenson, David	Democratic Candidate - State Representative 13th Middlesex District, 780 Chestnut St., Newton, Massachusetts
Moore, Johnes K.	Ass't. Professor, Salem State College Salem, Massachusetts 01970
Morgan, Allen H.	Executive Vice President, Massachusetts Audubon Society, Lincoln, Massachusetts 01773
Nason, Benjamin W.	Executive Director, Massachusetts Forest & Park Association, One Court Street, Boston, Massachusetts
O'Leary, Gerald F.	Boston City Council, City Hall, Government Center, Boston, Massachusetts 02201
Saltonstall, Sen. William L.	State Senator, 3rd Essex District, State House, Boston, Massachusetts
Saphir, Mrs. Nelson R.	Representing Mayor James R. McIntyre - City of Quincy, City Hall, Quincy, Massachusetts
Sirianni, Rep. Ralph E.	State Representative, 257 Winthrop Street Winthrop, Massachusetts
Smith, Mrs. Sherman L.	Representing Neighborhood Residents 196 Idlewell Blvd., Weymouth, Massachusetts
Tenenbaum, Oscar	Meteorologist in Charge, Dept. of Commerce, ESSA, Weather Bureau, Logan International Airport, East Boston, Massachusetts
Trafford, Miss Stella	League of Women Voters, 221 Beacon Street Boston, Massachusetts 02116
Walke, Mrs. Roger	State Water Chairman, League of Women Voters 114 Randolph Avenue, Milton, Mass. 02187

Name	Address
Attendees	
Abelson, Mark	Regional Coordinator, U. S. Dept. of the Interior, Room 2003, J. F. Kennedy Federal Bldg., Boston, Massachusetts 02203
Archibald, Frank L.	Environmental Engineer, Boston Edison Company 800 Boylston Street, Boston, Massachusetts 02199
Avery, Mrs. Abigail	Conservation Committee Chairman, Appalachian Mountain Club, 5 Joy St., Boston, Mass.
Barbour, William E.	Executive Director, Southeastern Massachusetts Regional Planning District, 123 N. Main Street, Fall River, Massachusetts 02720
Bates, Mrs. Howell A.	President, League of Women Voters of Mass. 120 Boylston Street, Boston, Mass. 02116
Belcher, C. Francis	Executive Director, Appalachian Mountain Club 5 Joy Street, Boston, Massachusetts 02108
Bergen, Lawrence J.	Water Resource Engineer, Basin Planning Section Corps of Engineers, New England Division, 424 Trapelo Road, Waltham, Massachusetts
Bergin, Francis T.	Sanitary Engineer, Met. Dist. Comm., 20 Somerset Street, Boston, Massachusetts
Black, Mrs. K. Charlton	Commissioner, Wayland Conservation Comm., 97 Lincoln Road, Wayland, Massachusetts 01778
Black, K. Charlton	Treasurer, Scientific Analysis Corporation 33 Sudbury Road, Concord, Massachusetts
Boschetti, Mario M.	Environmental Engineer, Massachusetts Dept. of Public Health, Room 511, State House, Boston, Massachusetts
Bryant, Edward A.	Associate, Tippetts-Abbott-McCarthy-Stratton 375 Park Avenue, New York, New York 10022
Burke, Mrs. Roger M.	Secretary, Massachusetts Conservation Council P. O. Box 315, Lincoln Center, Massachusetts
Callaghan, T. P.	Ass't. to Executive Director, Massachusetts Port Authority, 470 Atlantic Avenue, Boston, Massachusetts 02210

Name	Address
Attendees	
Centorino, James J.	Associate Professor, Salem State College Loring Avenue, Salem, Massachusetts
Clancy, James P. Mrs.	Neighborhood Residents, 209 Idlewell Blvd., Weymouth, Massachusetts
Collins, Mayor Francis X.	Mayor of Salem, Salem, Massachusetts
Conrod, Mrs. Vera	Local Chairman (Arlington) LWV-Disposal Committee, 19 Windemere Ave., Arlington, Massachusetts 02174
Corrieri, Marylou	Negotiator, Alice Sias Mem. Lab., 211 Summit Avenue, Brookline, Massachusetts 02146
Courtney, Joseph F.	Director, Area Development Center, Boston University, 398 Andover Street, Wilmington, Massachusetts 01887
Curran, Robert E.	President, New North River Association 55 Dearborn Street, Salem, Massachusetts
De Hart, Donald M.	Executive Director, New England Aquarium Central Wharf, Boston, Massachusetts 02110
De Mariano, Paul	Ass't. to T. P. Callaghan, Massachusetts Port Authority, 470 Atlantic Avenue, Boston, Mass.
Dimes, Richard	Former Selectman, Winthrop Citizens Group 105 Johnson Avenue, Winthrop, Massachusetts
Dimond, Mrs. F. Reginald	Water Committee Chairman, League of Women Voters, 1580 Wampanoag Trail, Barrington, R. I.
Dinsmore, A. F.	Hydraulic Engineer, Gibbs & Hill, Inc., 150 Causeway Street, Boston, Mass. 02114
Donheiser, Dr. Alan D.	Arthur D. Little, Inc., Cambridge, Mass. 02140
Fabuss, Dr. Bela M.	Technical Director, Lowell Technical Institute Research Foundation, 450 Aiken St., Lowell, Massachusetts
Folger, Commander W.	Chief Int. & Law Enforcement, U. S. Coast Guard c/o Commander 1st Coast Guard District, JFK Federal Bldg., Boston, Mass. 02203
Gehling, Raymond L. Jr.	Senior Supervisor of Conservation Education Mass. Dept. of Ed., 182 Tremont St. Boston, Mass.

Name	Address
Attendees	
Gray, Walter J.	Director, New England Marine Resources Information Program, University of Rhode Island, Kingston, Rhode Island
Johnson, Mrs. N.	Secretary, G. C. Mc Leod Sea-Farm Res., 181 West Street, Waltham, Massachusetts
Kennedy, Charles F.	Director and Chief Engineer, Massachusetts Water Resources Commission, 100 Cambridge St., Boston, Massachusetts
Knox, C. E.	District Chief, U. S. Geological Survey 2300 J. F. K. Federal Bldg., Boston, Mass.
Kuh, Peter H.	Executive Secretary, Water Pollution Advisory Board, U. S. Dept. of the Interior, Rm. 4140 18th & C Streets N. W., Washington, D. C.
Lach, M. J.	Manager Technical Analysis, Eastern Gas & Fuel Associates, 27 West St., Charlestown, Mass.
Larson, Charles	Sanitary Engineer, U. S. Public Health Service 1401 J. F. K. Federal Bldg., Boston, Mass. 02203
Larson, Peter W.	Coordinating Director, Charles River Watershed Ass'n., 460 Main Street, Walpole, Mass. 02081
Leffel, R. E.	Vice President, Camp, Dresser & McKee Intl., Inc., One Center Plaza, Boston, Massachusetts
Lewis, Mrs. Frank M.	Conservation Comm., Garden Club Fed. of Mass., 200 Boston Post Road, Weston, Mass. 02193
Lord, Sabin M. Jr.	Senior Sanitary Engineer, Commonwealth of Mass. Dept. of Natural Resources, Div. of Water Pollution Control, 100 Cambridge St., Rm. 1901 Boston, Massachusetts
Lyman, Mrs. G. H.	280 Dudley Street, Brookline, Mass. 02146
Lynde, Robert E.	Marine Forecasting Specialist, U. S. Weather Bureau, Logan Airport, E. Boston, Mass. 02128
Magill, John	Quality Assurance Manager, The Quaker Oats Co., Hillman & Water Sts., Box 810, New Bedford, Massachusetts
Mayfield, G. B.	Ass't. to Director, Avco Everett Research Lab. 2385 Revere Beach Pkwy., Everett, Mass.

Name	Address
Attendees	
McCall, Gerald W.	Sanitary Biologist, Division of Sanitary Engineering, Massachusetts Dept. of Public Health, 165 Hampshire Road, Methuen, Mass.
McCann, James A.	Leader, Mass. Coop. Fish Unit, Bureau of Sport Fisheries & Wildlife, University of Mass. Amherst, Massachusetts
Miller, David	Curator, New England Aquarium, Central Wharf Boston, Massachusetts 02110
Miller, Dr. Mary Emily	Associate Professor, Salem State College Salem, Massachusetts 01970
Morcom, Mrs. Margaret	League of Women Voters, Dexter Building Boston, Massachusetts
Moss, Sanford A.	Assistant Professor, S. E. Mass. Tech. Inst., Biology Department, North Dartmouth, Mass.
Nealom, Thomas F.	Quality Control Supt., Monsanto Company Chemical Lane, Everett, Massachusetts
Nickerson, Kenneth R.	Director of Research, The Gorton Corporation 327 Main Street, Gloucester, Massachusetts
Nordstrom, Robert D.	Staff Assistant to Congressman Hastings Keith of Massachusetts, Town Hall, West Bridgewater, Massachusetts
O'Donnell, Joseph W.	Regional Resource Development Agent, Cooperative Extension Service, 460 Main Street, Walpole, Massachusetts
O'Rourke, Hugh F.	Executive Secretary, Boston Fisheries Ass'n. Fish Pier, Boston, Massachusetts
Pelletier, Octave Daniel	Chairman, Algae Control & Conservation Comm. 404 Briggs Road, Westport, Massachusetts
Pentz, N. E.	Manager, Mechanical Engineering, Quaker Oats Company, Merchandise Mart Plaza, Chicago, Illinois 60654
Persson, Norma	P. O. Box 214, Sandwich, Massachusetts 02563
Putnam, John W.	RFD #1, Concord, Massachusetts 01742

Name	Address
Attendees	
Reed, Dr. Roger J.	Ass't. Unit Leader, Massachusetts Cooperative Fish Unit, Bureau of Sport Fisheries & Wildlife University of Massachusetts, Amherst, Mass.
Reynolds, John T.	Associate Professor (Microbiology) Clark University, 950 Main Street, Worcester, Massachusetts
Rice, Prof. David A.	Assistant Professor, Boston University School of Law, 765 Commonwealth Ave., Boston, Mass.
Richards, Cheryl	Student, 63 Elmhurst Road, Newton, Mass.
Rogers, William	Plant Manager, The Quaker Oats Company Hillman & Water Streets, New Bedford, Mass.
Russell, Mrs. Henry D.	Board Member, Charles River Watershed Ass'n. Springdale Avenue, Dover, Massachusetts 02030
Russell, Henry D. PhD.	Marine Biologist, Springdale Avenue, Dover, Massachusetts 02030
Schields, Miss Wilma	Head, Science Dept., A.I.B.S., 316 Hancock St., North Quincy, Massachusetts 02171
Segal, Mark	Inst. Agri. Indust. Microbiology, University of Massachusetts, Amherst, Massachusetts
Smith, Donna P.	Editor, North Shore '68, Essex County Newspapers, Inc., 23 Liberty Street, Newburyport, Massachusetts
Smith, Paul Ferris	Oceanographer, Geodyne Div., EG&G, Int., 10 Water Street, Woods Hole, Mass. 02543
Smith, Sherman L.	Idlewell Sec. of Weymouth, 196 Idlewell Blvd., Weymouth, Massachusetts
Stanley, LCDR H. E.	Deputy Group Commander, USCG Captain of the Port, 427 Commercial Street, Boston, Mass.
Steffek, Edwin F.	Editor "Horticulture" Massachusetts Hort. Soc. 300 Massachusetts Ave., Boston, Mass. 02115
Stotler, Thomas	Director Continuing Education, Massasoit Community College, North Abington, Mass. 02351
Tatlock, Richard	Research Associate, Harvard School of Design 1430 Mass. Ave., Cambridge, Mass. 02138

Name	Address
Attendees	
Taylor, Janet D.	Metropolitan Area Planning Council 44 School Street, Boston, Massachusetts
Tiffney, Wesley N.	Professor of Biology, Boston University 2 Cummington Street, Boston, Massachusetts
Toomey, John J.	Director, Health Department, 5 Broad Street Salem, Massachusetts
Ullman, Mrs. James R.	League of Women Voters, 168 Marlborough Street Boston, Massachusetts 02116
Velte, Richard G.	Mechanical Engineer, NEGEA Service Corp., 130 Austin Street, Cambridge, Mass. 02139
Watson, Clinton E.	Resources Planner, Division of Water Resources 100 Cambridge Street, Boston, Massachusetts
Weber, Mrs. Judith	Research Aide, Senator John J. Moakley, State House, Room 312, Boston, Massachusetts
West, Dr. Arthur J. II	Dean, Div. of Natural Sciences, New England College, Henniker, New Hampshire 03242
White, Mrs. Janet C.	Barrington League of Women Voters, 44 Massasoit Avenue, Barrington, Rhode Island
Wilder, Erwin S.	State Council of Sport Clubs of Mass., Inc., 319 Linwood Street, Lynn, Mass. 01905
Yeomans, Mrs. Frank E.	Secretary, Quincy Conservation Comm., 115 Winthrop Avenue, Quincy, Massachusetts
Zottoli, Robert	Associate Professor, Fitchburg State College Fitchburg, Massachusetts

INDEX

Alperin, Irving 42

Appalachian Mountain Club 127

Aquacultural Research Corporation 106

Archibald, Francis L. 134

Audubon Society (Massachusetts) 46

Avery, Mrs. Abigail D. 127

Backoff, Frank 89

Barbour, William E. 117

Bates, Congressman William H. 32

Bates, Mrs. Howell A. 53

Becker, E. Brooks 164

Belcher, C. Francis 127

Black, K. C. 115

Blandin, Warren 96

Boston Edison Company 134

Brooke, Senator Edward W. (Massachusetts) 31

Bumpus, Dean 34

Cape Cod Planning & Economic Development Commission 135

Carriker, Melbourne 85

Clancy, Mrs. James 92

Cole, Charles F. 80

Collins, Mayor Francis (Salem, Mass.) 39

Conover, John 98

Conrod, Alfred C. 97, 154

Conroy, Joseph L. 164

Conroy, Ruth F. 164

Cultured Clam Corporation 106

David, James F. 164

Davidson, Robert G. 130

Davis, E. Fletcher 135

Davis, James E. 164

Di Carlo, Representative Joseph C. 17

Donahue, Senator Maurice A. (Massachusetts) 34

Fabuss, B. M. 160

Faux, Jaques A. 164

Foster, Charles H. W. 109

Harleman, Donald R. F. 58, 122

Izaak Walton League 89

Kanter, Thelma 164

Kennedy, Charles 41

Kennedy, Senator Edward (Massachusetts) 3

King, James 3

Klashman, Lester M. 1, 11, 15, 24, 37, 43, 89, 97

La Roque, Paul K. 61

League of Women Voters (Beacon Hill Chapter) 98

League of Women Voters (Massachusetts) 53

Lebourveau, John W. 65

Lindberg, Clifford, Jr. 164

Lindberg, Jane A. 164

Loring, Richard 106

Lowell Technological Institute Research Foundation 160

Lyman, Henry 70

Marine Biological Laboratory (Woods Hole, Mass.) 85

Marine Fisheries Advisory Committee 89

Marshall, Roger 92

Massachusetts Conservation Council 46

Massachusetts Cooperative Fishery Unit 81

Massachusetts Dept. of Natural Resources (Division of Fisheries & Game) 96

Massachusetts Dept. of Natural Resources (Division of Marine Fisheries) 42

Massachusetts Forest & Park Association 103

Massachusetts Institute of Technology (Civil Engineering Dept.) 122

Massachusetts Institute of Technology (Dept. of Aeronautics & Astronautics) 154

Massachusetts, University of 81

Massasoit Community College (Natural Resources) 161

McIntyre, Mayor James R. (Quincy, Mass.) 26

McMahon, Thomas 41

Metropolitan Area Planning Council (Boston, Mass.) 130

Metropolitan District Commission (Boston, Mass.) 124

Moakley, Sanator John J. (Massachusetts) 39

Mofenson, David 39

Moore, Johnes K. 56

Morgan, Allen H. 46

Nason, Benjamin 103

New England Aquarium 74

New England Electric System 65

New North River Association 63

O'Leary, Gerald F. 63

O'Neal, Frederick 164

Ottaway, James H., Jr. 166

Pahren, Herbert 44, 53, 55, 91

Peloquin, Alfred E. 15, 79

Russell, Henry D. 46

Ryther, John H. 119

Salem State College 56

Salt Water Sportsman 70

Saltonstall, Senator William L. (Massachusetts) 11

Saphir, Mrs. Nelson R. 26

Scientific Analysis Corporation 115

Sierra Club 92

Sirianni, Representative Ralph E. (Massachusetts) 9

Smith, Mrs. Sherman 92

Southeastern Massachusetts Regional Planning District 117

Souza, George 151

Sprout, Gerald 164

Standard-Times (New Bedford, Mass.) 166

Tenenbaum, Oscar 106

Trafford, Miss Stella 98

U. S. Dept. of Commerce, ESSA, Weather Bureau 106

Vinal, William 161

Vincent, Ted 167

Walke, Mrs. Roger 53

Weymouth Neighborhood Residents 92

Whitmore, Howard, Jr. 124

Woods Hole Oceanographic Institution 119

Yasi, Robert 41

Zabriskie, Albert 41, 44, 69, 95